Technical and Professional Education

Curriculum Content Frameworks for Major Appliance Technology

Curriculum Content Frameworks for
Major Appliance Technology
Developed by the
University of Arkansas at Little Rock

State of Arkansas
Department of Workforce Education

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Preface

The Technical & Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as All Aspects of the Appliance Repair Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical & Professional Education programs can be accessed through the Department of Workforce Education Web site.

Foreword

The curriculum content framework *Major Appliance Technology* supports the course that prepares students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the appliance repair industry.

CIP Code – 47.0106
O-NET – 49-9031.XX
Major Appliance Installer and Repaired

Acknowledgments

The Major Appliance Technology curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. A panel of experts in the field of appliance repair reviewed the framework. The content of the framework was adapted from a student study guide developed by the Multistate Academic and Vocational Curriculum Consortium (MAVCC) to reflect the specific training needs within the state of Arkansas. The framework format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education and MAVCC for granting the Arkansas State's Department of Workforce Education access to their instructional frameworks.

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Table of Contents

Introduction

About the Program

Major Appliance Technology prepares students for careers in appliance repair industry. The course sequence focuses on duties and tasks performed by appliance repair technicians, as well as pre-employment and employment skills.

About the Document

This document includes the following components:

- Section 1 contains a master duty/task list for the Major Appliance Technology program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Major Appliance Technology program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Major Appliance Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by those in the Major Appliance industry.

Program Description

495250 - Major Appliance Technology I

495270 - Major Appliance Technology II

495260 – Major Appliance Technology Lab

Master Duty/Tasks Listing
Major Appliance Technology
Major Appliance Technology I
Major Appliance Technology II

National and state experts in the occupational field of Major Appliance Technology have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty*/*task statement*, which describes what the student is to do

DUTY A: **Demonstrate Knowledge of Safety and First Aid**
Task:
A001: Discuss terms and definitions as they relate to safety and first aid
A002: Review benefits of safe working practices.
A003: List major causes of accidents
A004: Practice housekeeping in the workplace
A005: Comply with rules for safe use of tools and equipment.
A006: Practice safe lifting
A007: Discuss information and details contained in a MSDS (Material Safety Data Sheet)
A008: Discuss the diamond classification system for hazardous materials
A009: Discuss fire safety
A010: Describe special safety requirements for appliance repair
A011: List special rules for eye protection
A012: Review general guidelines for first aid emergencies

DUTY B: **Discuss the Fundamentals of Electricity**
Task:
B001: Discuss terms and definitions as they relate to electricity
B002: List the sources of electricity and their characteristics
B003: Discuss the electron theory
B004: Describe conductors, insulators, and semiconductors
B005: Review direct current
B006: Review alternating current
B007: Identify basic electrical symbols
B008: Describe elements of a basic circuit
B009: Discuss circuit applications
B010: Define circuit grounding
B011: Review electrical measurements in circuits
B012: Discuss Ohm's law for electrical circuits
B013: Describe characteristics of electrical power
B014: Define Kirchhoff's law for voltage and current
B015: Discuss working with resistors

DUTY C: **Demonstrate Knowledge of AC Induction Motors**
Task:
C001: Discuss terms and definitions as they relate to AC induction motors
C002: Describe principles of magnetism
C003: Apply left hand rule for conductors
C004: Discuss types of transformers
C005: Describe DC motor components
C006: Describe operation of a DC motor
C007: Review aspects of AC induction motors
C008: List components of an AC induction motor and their functions
C009: Describe types of AC induction motors
C010: Describe motor housings
C011: Discuss motor speeds
C012: Review types of motor bearings and their characteristics
C013: Define function of motor thermal protection
C014: Discuss miscellaneous motor problems
C015: Describe use of compressor test cords in motor testing
C016: Review guidelines for servicing throwaway motors

C017: List content of motor nameplate
C018: Review motor safety
C019: Review steps in systematically troubleshooting an induction motor
C020: Troubleshoot an AC induction motor to test for thermal overload problems.
C021: Troubleshoot an AC induction motor to determine whether start mechanism or start windings are bad, and replace centrifugal switch.
C022: Bench test single-speed motor with a test cord.
DUTY D: **Demonstrate Knowledge of Diagrams and Schematics**
Task:
D001: Discuss terms related to diagrams and schematics with their correct definitions.
D002: Describe elements and characteristics of block diagrams.
D003: Review elements and characteristics of schematic diagrams
D004: Solve problems about wiring diagrams.
D005: Describe graphic aids and their functions as used in diagrams and schematics
D006: Describe timer sequence charts
D007: Define function of legends
D008: Review list a common color code abbreviations
D009: Identify basic electrical symbols.
D010: Discuss type and function of solid-state devices

D011: Review guidelines for using diagrams and schematics.
D012: Interpret a timer sequence chart and wiring diagram for an automatic washer.
DUTY E: **Demonstrate Knowledge of Tools, Materials, and Test Instruments**
Task:
E001: Discuss terms and definitions as they relate to tools, materials, and test instruments
E002: Discuss type, function, and care of tools, materials, and test equipment used in appliance repair.
E003: List required appliance repair literature and their uses.
E004: Describe function of shunts in ammeters
E005: List types of electrical measurements and methods used to accomplish them.
E006: List types of appliance wiring and methods of identification
E007: Identify soldering tools
E008: Discuss characteristics and application of resin-core and solid wire solder
E009: Perform in sequence, procedures for wire stripping
E010: Perform wire splicing
E011: Review guidelines for connections at screw terminals
E012: Splice electrical conductors to acceptable service standards

E013: Review guidelines for using solderless connectors and terminals
E014: Review types of eye protection and their proper use
E015: Test electrical receptacles for correct voltage
E016: Use a clamp-on ammeter to test for high and low amperages on a fan motor and a light bulb
E017: Check continuity of a magnetic control assembly from an automatic washer
E018: Use a VOM for a quick capacitor check
DUTY F: **Demonstrate Knowledge of Installation and Troubleshooting Automatic Washers**
Task:
F001: Discuss terms and definitions as they relate to automatic washers
F002: Review function of major components found in automatic washers
F003: Describe sequence of typical automatic washer cycle
F004: Describe fill functions in a normal cycle
F005: Describe agitation in a normal cycle
F006: Describe pumpout and spin functions in a normal cycle
F007: Review guidelines for evaluating automatic washer malfunctions
F008: Review in sequence, steps followed in validating repairs
F009: Troubleshoot a washer that will not fill with water

F010: Troubleshoot a washer for improper water level or water temperature
F011: Troubleshoot a washer that will not shut off
F012: Troubleshoot a washer that leaks water
F013: Troubleshoot water that will not drain from washer
F014: Troubleshoot a washer with a motor that will not run
F015: Troubleshoot a washer that will not agitate
F016: Troubleshoot a washer that will not spin
F017: Troubleshoot a washer that will not advance or shut off
F018: Troubleshoot a washer that leaks oil
F019: Troubleshoot a washer that tears clothes
F020: Troubleshoot a washer for additional miscellaneous problems
F021: Install an automatic washer
F022: Troubleshoot a microprocessor control panel for typical malfunctions
DUTY G: **Demonstrate Knowledge of Automatic Dryers**
Task:
G001: Discuss terms with definitions related to automatic dryers
G002: Match major components with their functions in an automatic dryer
G003: Arrange in order the steps in automatic dryer operation

G004: Explain functions of thermostats in automatic dryers
G005: Troubleshoot a dryer that will not run
G006: Troubleshoot a dryer that will run but not heat
G007: Troubleshoot a dryer who's motor runs drum will not rotate
G008: Troubleshoot a dryer that runs but will not shut off
G009: Troubleshoot a dryer that runs and heats but will not dry clothes
G010: Troubleshoot automatic dryers with additional miscellaneous problems
G011: Troubleshoot gas valves and igniters on gas dryers
G012: Troubleshoot special gas dryer problems
G013: Troubleshoot a microprocessor control board for typical malfunctions
G014: Install an automatic dryer
DUTY H: **Demonstrate Knowledge of Automatic Dishwashers**
Task:
H001: Discuss terms with definitions related to automatic dishwashers
H002: Describe major components and their functions in automatic dishwashers
H003: Arrange in order the typical steps in an automatic dishwasher cycle
H004: Review special considerations for dishwasher installation

H005: Describe water problems associated with dishwashers
H006: Review loading order in dishwasher operations
H007: Discuss common dishwasher misuses and their causes
H008: Review guidelines for better dishwasher service
H009: Discuss guidelines for troubleshooting automatic dishwashers
H010: Describe methods for preventing mineral build-up in an automatic dishwasher
H011: Install an automatic dishwasher under a counter
H012: Troubleshoot malfunctions on an automatic dishwasher
H013: Inspect the seal on an automatic dishwasher
DUTY I: **Demonstrate Knowledge of Garbage Disposals**
Task:
I001: Discuss terms with definitions as they relate to garbage disposals
I002: Discuss safety rules related to repair and operation of garbage disposals
I003: Match major components of a disposal with their functions.
I004: Describe in order the steps in garbage disposal operations
I005: Discuss importance of cold water flow in disposals
I006: Identify common misuses of disposals that cause problems
I007: List items that can be placed into a garbage disposal

I008: Discuss guidelines for handling a jammed garbage disposal
I009: Discuss procedures for installing a garbage disposal
I010: Discuss guidelines for troubleshooting garbage disposal malfunctions
I011: Install a garbage disposal
I012: Free a jammed garbage disposal
DUTY J: **Demonstrate Knowledge of Trash Compactors**
Task:
J001: Discuss terms related to trash compactors with their definitions
J002: Review characteristics of trash compactors
J003: Arrange in order the steps in a typical compactor cycle
J004: Describe trash compactor electrical components and their characteristics
J005: Review safe operation of trash compactor
J006: Discuss guidelines for properly loading a compactor
J007: Discuss common causes of failure in trash compactors
J008: Discuss major wear problems with trash compactors
J009: Review lubrications requirements for trash compactors
J010: Review procedures for adjusting chains and belts
J011: Review troubleshooting guidelines for trash compactors

J012: Troubleshoot a noisy compactor
J013: Troubleshoot other compactor problems
J014: Review items to avoid placing in a trash compactor
J015: Use schematics to determine operating conditions on a trash compactor
J016: Install an under-counter trash compactor to specifications
J017: Test the drive motor on a trash compactor to determine its operational condition
J018: Troubleshoot a trash compactor for typical malfunctions
DUTY K: **Demonstrate Knowledge of Gas Ranges and Ovens**
Task:
K001: Discuss terms and their definitions related to gas ranges and ovens
K002: Review basics of gas heating
K003: Discuss characteristics and safety considerations of natural and bottled gas
K004: Review operation of a gas range top burner
K005: Discuss orifice settings
K006: Explain primary and secondary air
K007: Review byproducts of combustion
K008: Discuss solutions for burner combustion problems
K009: Review types of gas burners and applications of each

K010: Review types of oven ignition systems and their characteristics
K011: Explain how a gas oven works
K012: List types of oven thermostats and their characteristics
K013: Describe safety valves and their functions
K014: Review misuses of gas stoves
K015: Discuss considerations for ovens with upper and lower burners
K016: Explain how self-cleaning ovens work
K017: Describe special safety features of self-cleaning ovens
K018: Discuss safety requirements for gases
K019: Describe flexible connectors and their uses
K020: Review requirements for gas supply lines
K021: Explain functions of electrical circuits on gas ovens
K022: Discuss typical functions of circuits on gas ovens
K023: Match gas range complaints with recommended troubleshooting
K024: Discuss gas pressure drops and their causes
K025: Discuss manometer selection and use
K026: List common solutions to baking problems

K027: Discuss guidelines for customer service calls
K028: Determine voltage and resistance readings on a self-cleaning gas oven set for a bake operation
K029: Determine voltage and resistance readings on a self-cleaning gas oven set for a timed bake operation
K030: Determine voltage and resistance readings on a self-cleaning gas oven set for a cleaning operation
K031: Determine voltage and resistance readings on a self-cleaning gas oven during lock and unlock
K032: Install a gas range level and leak free with all burners properly adjusted
K033: Check gas oven temperature for proper oven thermostat settings
K034: Recalibrate a gas oven thermostat to correct settings
K035: Remove, disassemble, clean, lubricate, and reassemble a standard gas burner valve
DUTY L: **Demonstrate Knowledge of Electric Ranges and Ovens**
Task:
L001: Discuss terms with their definitions related to electric ranges and ovens
L002: State electrical requirements for hooking up an electric range
L003: Review basics of electric cooking
L004: Discuss electric surfaces and oven heating elements
L005: Differentiate between types of heat controls for surface heating elements.
L006: List types and characteristics of electric oven thermostats
L007: Recalibrate electric oven thermostats

L008: Discuss electric oven self-cleaning operations
L009: Match components with their functions in a self-cleaning cycle
L010: Troubleshoot an electric range
L011: Check surface units from an electric range for proper resistance
L012: Check the self-cleaning function on an electric oven
L013: Check step-type and infinite electric range switches for continuity
DUTY M: **Demonstrate Knowledge of Microwave Ovens**
Task:
M001: Discuss terms and definitions related to microwave ovens
M002: Review fundamentals of microwave operations and the science involved
M003: Discuss microwave oven controlling standards with their controlling agencies
M004: List performance standards for microwave ovens
M005: Match basic components with their functions in a microwave oven
M006: Discuss magnetron structure and operation
M007: Discuss significance of microwave reflection
M008: Discuss significance of microwave transmission
M09: Discuss significance of microwave absorption
M010: Explain how microwaves cook food

M011: Review procedures for installing a microwave oven
M012: List rules for preventative maintenance on microwave ovens
M013: Review major microwave oven components and their functions
M014: Review standards for RF leakage test instruments
M015: List operating controls and their functions
M016: Describe type motors used in microwave ovens and their functions
M017: Explain function of door seals as part of the construction of a microwave oven
M018: List printed materials required to service microwave ovens
M019: Troubleshoot a microwave oven
M020: Discuss safety requirements for microwave oven service
M021: Perform Circuit Diagnosis for various electrical systems
M022: Test the interlock system on microwave oven for safe operation
M023: Check an RF leakage test meter and check a microwave oven for RF leakage
M024: Clean and deodorize a microwave oven
M025: Discharge a capacitor
M026: Check stirrer blade rotation and remove and disassemble a stirrer system
M027: Replace and adjust a microwave oven door assembly

M028: Conduct power tests on a microwave oven to check for temperature rise under full power
M029: Test and replace high voltage components when an oven produces little or no heat
M030: Remove a blower motor and transformer and remove and reinstall a magnetron
M031: Check the interlock switch module on a microwave oven
M032: Test and replace magnetron and cavity thermal protectors
M033: Test and replace a low voltage transformer and a triac module
M034: Test a temperature probe and probe jack
M035: Test and replace an oven timer and controller
M036: Remove, test and replace a control board
M037: Test a control circuit board
M038: Test a cook relay
M039: Test and replace a turntable motor
DUTY N: **Demonstrate Knowledge of Refrigeration Principals and Perform Refrigerator Diagnosis In Accordance With EPA Regulations**
Task:
N001: Discuss heat as it relates to the principles of refrigeration .
N002: Differentiate between gauge and absolute pressures
N003: Describe Charles Law
N004: Describe matter and changes of state

N005: Discuss refrigerant
N006: Describe the refrigeration cycle
N007: Understand the electrical theory of operation of a refrigerator.
N008: Discuss the various electrical components that are found in a typical refrigerator.
N009: Install a typical refrigerator ice maker, water line, and level
N010: Diagnose and repair electric failures in a refrigerator using a Voltmeter, Ohmmeter, Ammeter, and Wattmeter.
N011: Diagnose and repair common refrigerator malfunctions

Task Definitions

National and state experts in the occupational field of Major Appliance Technology have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

DUTY A: **Demonstrate Knowledge of Safety and First Aid**
Task:
A001: Discuss terms and definitions as they relate to safety and first aid *Definition:* Process should include the following: • state terms and definitions associated with safety and first aid Process/Skill Questions:
A002: Review benefits of safe working practices. *Definition:* Process should include the following: • list safe work practices Process/Skill Questions:
A003: List major causes of accidents *Definition:* Process should include the following: • list examples of unsafe work conditions • list examples of unsafe acts • list examples of accidents caused by combination of unsafe conditions and acts Process/Skill Questions:
A004: Practice good housekeeping in the workplace *Definition:* Process should include the following: • state good housekeeping practices for the workplace Process/Skill Questions:

A005: Comply with rules for safe use of tools and equipment.

Definition: Process should include the following:

- state commonly accepted rules for safe use of tools and equipment

Process/Skill Questions:

A006: Practice safe lifting

Definition: Process should include the following:

- review practices used for safe lifting
- list specific safety rules followed for appliance repair

Process/Skill Questions:

A007: Discuss information and details contained in a MSDS (Material Safety Data Sheet)

Definition: Process should include the following:

- review chemical name, hazardous ingredients/chemical identity, physical characteristics, fire and explosive data, reactivity, health hazards, usage, handling, and storage, and special protection and precautions.
- describe problems and health effects of hazardous chemicals

Process/Skill Questions:

A008: Discuss the diamond classification system for hazardous materials

Definition: Process should include the following:

- review diamond classification system
- review diamond coding system
- review function of numeric codes 1 thru 4
- identify abbreviations and symbols

Process/Skill Questions:

A009: Discuss fire safety

Definition: Process should include the following:

- state fire safety rules commonly followed in the workplace
- review classes of fires and their causes
- discuss types of fire extinguishers, their recommended uses, and operations

Process/Skill Questions:

A010: Describe special safety requirements for appliance repair

Definition: Process should include the following:

- state special safety requirements for appliance repair

Process/Skill Questions:

A011: List special rules for eye protection

Definition: Process should include the following:

- list types of eye protection used in the workplace

Process/Skill Questions:

A012: Review general guidelines for first aid emergencies

Definition: Process should include the following:

- state symptoms of shock
- list first aid steps followed for electrical shock
- list guidelines for common workplace injuries
- list steps followed when treating burns
- list steps followed when controlling bleeding
- identify pressure points used to control bleeding
- list steps followed when treating eye injuries

Process/Skill Questions:

DUTY B:
Discuss the Fundamentals of Electricity

Task:

B001: Discuss terms and definitions as they relate to electricity

Definition: Process should include the following:

- state terms and definitions as they relate to electricity

Process/Skill Questions:

B002: Review sources of electricity and their characteristics

Definition: Process should include the following:

- list sources of electricity and their characteristics to include friction, chemical reaction, magnetism, photoelectric surfaces, heat, and mechanical pressure

Process/Skill Questions:

B003: Discuss the electron theory

Definition: Process should include the following:

- review characteristics of neutrons, electrons, and electrical charges
- state electron theory

Process/Skill Questions:

B004: Describe conductors, insulators, and semiconductors

Definition: Process should include the following:

- explain electron flow in a conductor
- state function and characteristics of conductors, insulators, and semiconductors

Process/Skill Questions:

B005: Review direct current

Definition: Process should include the following:

- define direct current and it's characteristics
- describe non-fluctuating, fluctuating, and pulsating direct current
- list common sources of direct current

Process/Skill Questions:

B006: Review alternating current

Definition: Process should include the following:

- define alternating current and it's characteristics
- define cycle

Process/Skill Questions:

B007: Identify basic electrical symbols

Definition: Process should include the following:

- list basic electrical symbols

Process/Skill Questions:

B008: Describe elements of a basic circuit

Definition: Process should include the following:

- list basic components of a circuit

Process/Skill Questions:

B009: Discuss circuit applications

Definition: Process should include the following:

- define a series circuit and their uses
- define parallel circuit and their uses

Process/Skill Questions:

B010: Define circuit grounding

Definition: Process should include the following:

- state function of grounding
- state process of grounding

Process/Skill Questions:

B011: Review electrical measurements in circuits

Definition: Process should include the following:

- state function of electrical measurement in circuit
- list specialized equipment used in electrical measurement in circuits

Process/Skill Questions:

B012: Discuss Ohm's law for electrical circuits

Definition: Process should include the following:

- state Ohm's law for electrical circuits
- identify abbreviations and their meanings in Ohm's law
- determine unknown values in a circuit using Ohm's law
- list ways Ohm's law can be used

Process/Skill Questions:

B013: Describe characteristics of electrical power

Definition: Process should include the following:

- define watt in an electrical circuit
- define power in an electrical circuit
- state basic formulas for calculating power in an electrical circuit

Process/Skill Questions:

B014: Define Kirchhoff's law for voltage and current

Definition: Process should include the following:

- state Kirchhoff's law for voltage
- state Kirchhoff's law for current

Process/Skill Questions:

B015: Discuss working with resistors

Definition: Process should include the following:

- list types of resistors
- state characteristics and function of a resistor
- state value of a resistor
- list steps in using the color code to determine resistor value

Process/Skill Questions:

DUTY C:
Demonstrate Knowledge of AC Induction Motors

Task:

C001: Discuss terms and definitions as they relate to AC induction motors

Definition: Process should include the following:

- review terms and definitions as they relate to AC induction motors

Process/Skill Questions:

C002: Describe magnetism

Definition: Process should include the following:

- state elements of magnetism to include flux, molecule arrangement, type charges and their effects, polarity, coil, and electromagnetic field.
- review relationship of elements

Process/Skill Questions:

C003: Apply left hand rule for conductors

Definition: Process should include the following:

- define current flow
- state "left-hand rule

Process/Skill Questions:

C004: Discuss types of transformers

Definition: Process should include the following:

- describe step-up, step-down, and isolation transformers and their functions
- state formula for determining voltage in a transformer

Process/Skill Questions:

C005: Describe DC motor components

Definition: Process should include the following:

- identify an armature
- identify a split-ring commutator
- identify brushed
- identify location of magnetic field

Process/Skill Questions:

C006: Describe operation of a DC motor

Definition: Process should include the following:

- review relationship of the armature, brushes, commutator, and switch as they function within a DC motor.

Process/Skill Questions:

C007: Review aspects of AC induction motors

Definition: Process should include the following:

- list advantages of AC induction motors over DC motors
- state function of a AC induction motor
- define run windings and their function

Process/Skill Questions:

C008: List components of an AC induction motor and their functions

Definition: Process should include the following:

- identify the motor housing
- identify the stator
- identify the rotor
- locate the centrifugal switch
- locate the thermal overload
- identify the end bells
- locate the assembly bolts

Process/Skill Questions:

C009: Describe types of AC induction motors

Definition: Process should include the following:

- state how AC induction motors are identified
- review operation of induction start, induction run motors
- review operation of capacitor start, induction run motors
- review operation of capacitor start, capacitor run motors

Process/Skill Questions:

C010: Describe motor housings

Definition: Process should include the following:

- list functions and characteristics of motor housing

Process/Skill Questions:

C011: Discuss motor speeds

Definition: Process should include the following:

- review single-speed motors
- review two-speed motors
- review three-speed motors

Process/Skill Questions:

C012: Review types of motor bearings and their characteristics

Definition: Process should include the following:

- list characteristics of sleeve bearings
- list characteristics of roller bearings
- list characteristics of ball bearings

Process/Skill Questions:

C013: Define function of motor thermal protection

Definition: Process should include the following:

- state function of thermal protection
- state function of overload device

Process/Skill Questions:

C014: Discuss miscellaneous motor problems

Definition: Process should include the following:

- review low voltage
- review high voltage
- review excess voltage
- review over lubrication of motors
- review motor overload
- review belt adjustments

Process/Skill Questions:

C015: Describe use of compressor test cords in motor testing

Definition: Process should include the following:

- list problems to be evaluated by a compressor test cord
- review bench testing with compressor test cords
- review safety considerations with compressor test cords

Process/Skill Questions:

C016: Review guidelines for servicing throwaway motors

Definition: Process should include the following:

- state guidelines for servicing throwaway motors

Process/Skill Questions:

C017: List content of motor nameplate

Definition: Process should include the following:

- identify location of motor nameplate
- locate model number, serial number, type, and horsepower rating
- locate hertz, voltages, FLA, LRA, and SF
- locate RPM, FR, Temp Rise, and duty rating

Process/Skill Questions:

C018: Review motor safety

Definition: Process should include the following:

- state safety procedures followed while servicing electric motors

Process/Skill Questions:

C019: Review steps in systematically troubleshooting an induction motor

Definition: Process should include the following:

- list systematically procedures followed when troubleshooting an induction motor

Process/Skill Questions:

C020: Troubleshoot an AC induction motor to test for thermal overload problems.

Definition: Process should include the following:

- comply with all industry accepted procedures for troubleshooting an AC induction motor

Process/Skill Questions:

C021: Troubleshoot an AC induction motor to determine whether start mechanism or start windings are bad, and replace centrifugal switch.

Definition: Process should include the following:

- comply with all industry accepted procedures for troubleshooting an AC induction motor

Process/Skill Questions:

C022: Bench test single-speed motor with a test cord.

Definition: Process should include the following:

- comply with all industry accepted procedures for bench testing a single-speed motor with a test cord

Process/Skill Questions:

DUTY D:
Demonstrate Knowledge of Diagrams and Schematics

Task:

D001: Discuss terms related to diagrams and schematics with their correct definitions.

Definition: Process should include the following:

- match terms and definitions as they relate to diagrams and schematics

Process/Skill Questions:

D002: Describe elements and characteristics of block diagrams.

Definition: Process should include the following:

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Process/Skill Questions:

D003: Review elements and characteristics of schematic diagrams

Definition: Process should include the following:

-

Process/Skill Questions:

D004: Solve problems about wiring diagrams.

Definition: Process should include the following:

- Describe function of wiring diagrams

Process/Skill Questions:

D005: Describe graphic aids and their functions as used in diagrams and schematics

Definition: Process should include the following:

- review phantom views
- review cutaway views
- review detail views
- review section views
- review exploded views
- review wiring harness diagrams

Process/Skill Questions:

D006: Describe timer sequence charts

Definition: Process should include the following:

- state functions of timer sequence charts

Process/Skill Questions:

D007: Define function of legends

Definition: Process should include the following:

- state meanings of color codes
- review content of special circuitry legend

Process/Skill Questions:

D008: Review list a common color code abbreviations

Definition: Process should include the following:

- list common color code abbreviations
- state function of a tracer color
- state abbreviations for black, brown, blue, light blue, green, gray, orange, pink, purple, red, tan, violet, white, yellow, and tracer
- state function of a timer sequence chart

Process/Skill Questions:

D009: Identify basic electrical symbols.

Definition: Process should include the following:

- identify symbols for types of wiring, type grounding, type protection devices, type switches, momentary switch, water level switch, centrifugal switch, solenoid, type motors, type, capacitor, type resistor, thermostats and thermocouples, type lights, terminals, coils, and transformers.

Process/Skill Questions:

D010: Discuss type and function of solid-state devices

Definition: Process should include the following:

- identify symbols for types of solid state controls
- state advantages of solid state devices

Process/Skill Questions:

D011: Review guidelines for using diagrams and schematics.

Definition: Process should include the following:

- list guidelines commonly followed while using diagrams and schematics.

Process/Skill Questions:

D012: Interpret a timer sequence chart and wiring diagram for an automatic washer.

Definition: Process should include the following:

- describe a timer sequence chart and wiring diagram for an automatic washer

Process/Skill Questions:

DUTY E:
Demonstrate Knowledge of Tools, Materials, and Test Instruments

Task:

E001: Discuss terms and definitions as they relate to tools, materials, and test instruments

Definition: Process should include the following:

- state terms and definitions as they relate to tools, materials, and test instruments

Process/Skill Questions:

E002: Discuss type, function, and care of tools, materials, and test equipment used in appliance repair.

Definition: Process should include the following:

- list type, function, and care of basic hand tools to include screwdrivers, nut drivers, pliers, open end wrenches, snips, ratchet/socket sets, hand-held drills/bit sets, chisels and punches, files, hex key sets, hammers, and wrenches
- list type, function, and care of shop tools to include dollies, appliance flippers, air compressor, bearing remover/installer, spanner wrench, and wet/dry vacuum
- list type, function, and care of test equipment to include VOMS, clamp-on ammeters, digital multimeters, temperature testers, capacitor analyzers, and watt meters,
- list type, function, and care of miscellaneous supplies to include type tapes, high temperature lubricants and adhesives, rubber adhesive, multipurpose lubricants, degreasers and detergents, leak-testing liquid and brush

Process/Skill Questions:

E003: List required appliance repair literature and their uses.

Definition: Process should include the following:

- locate service manuals, schematics, parts catalogs, and technical updates appropriate to the appliances being repaired

Process/Skill Questions:

E004: Describe function of shunts in ammeters

Definition: Process should include the following:

- define function and uses of shunts in ammeters

Process/Skill Questions:

E005: List types of electrical measurements and methods used to accomplish them.

Definition: Process should include the following:

- state method used to measure voltage
- state method used to measure amperage
- state method used to measure resistance

Process/Skill Questions:

E006: List types of appliance wiring and methods of identification

Definition: Process should include the following:

- state how wiring is selected using an AWG number
- list type wiring insulation to include RHW, THW, and AA—A
- state function of ampacity

Process/Skill Questions:

E007: Identify soldering tools

Definition: Process should include the following:

- identify a 150 to 250 watt soldering gun and its applications
- identify a large soldering iron of 40 to 1560 watts and it's applications
- identify a pencil iron rated at 20 watts or less and it's applications

Process/Skill Questions:

E008: Discuss characteristics and application of resin-core and solid wire solder

Definition: Process should include the following:

- describe 40/60 resin-core solder and it's uses
- describe solid wire solder and it's uses
- describe function of flux
- discuss in sequence, procedures for using resin-core and solid wire solder

Process/Skill Questions:

E009: Perform in sequence, procedures for wire stripping

Definition: Process should include the following:

- select appropriate tool for wire stripping
- discuss procedures followed in wire stripping

Process/Skill Questions:

E010: Perform wire splicing

Definition: Process should include the following:

- describe splicing techniques to include simple, simple tap, pigtail, and hook
- discuss splicing procedures

Process/Skill Questions:

E011: Review guidelines for connections at screw terminals

Definition: Process should include the following:

- identify correct direction of wire loop in relation to terminal screw

Process/Skill Questions:

E012: Splice electrical Conductors to Acceptable Service Standards

Definition: Process should include the following:

- select tools and materials
- splice and solder simple splices using single and stranded wire
- make two pigtail splices, one using screw-on caps and one using solder
- splice and solder a tap splice using single wire as well as stranded wire

Process/Skill Questions:

E013: Review guidelines for using solderless connectors and terminals

Definition: Process should include the following:

- review use of screw-on connectors
- review use of crimp-on terminal lugs
- state considerations when solderless connectors and terminals

Process/Skill Questions:

E014: Review types of eye protection and their proper use

Definition: Process should include the following:

- list types of eye protection to include safety glasses, and face shields
- match work activity with appropriate eye protection

Process/Skill Questions:

E015: Test electrical receptacles for correct voltage

Definition: Process should include the following:

- discuss procedures for testing a receptacle
- review precautions followed when testing receptacles

Process/Skill Questions:

E016: Use a clamp-on ammeter to test for high and low amperages on a fan motor and a light bulb

Definition: Process should include the following:

- discuss procedure for testing high and low amperages using a clamp-on ammeter
- review precautions followed when testing amperage

Process/Skill Questions:

E017: Check continuity of a magnetic control assembly from an automatic washer

Definition: Process should include the following:

- check solenoids with VOM at R **x** 1 scale
- check solenoids with VOM at R **x** 100 scale
- monitor meter deflections
- compare readings at 525 ohms

Process/Skill Questions:

E018: Use a VOM for a quick capacitor check

Definition: Process should include the following:

- discharge capacitor as safety precaution
- attach VOM leads on capacitor terminals
- reverse VOM leads on capacitor terminals
- evaluate capacitor as good, shorted or open

Process/Skill Questions:

DUTY F:
Demonstrate Knowledge of Installation and Troubleshooting Automatic Washers

Task:

F001: Discuss terms and definitions as they relate to automatic washers

Definition: Process should include the following:

- state terms and definitions related to troubleshooting automatic washers

Process/Skill Questions:

F002: Review function of major components found in automatic washers

Definition: Process should include the following:

- list the major components found in a automatic washer to include a timer, motor, transmission, water pump, and water pressure/level switch

Process/Skill Questions:

F003: Describe sequence of typical automatic washer cycle

Definition: Process should include the following:

- state steps in a typical automatic washer cycle to include first fill, wash agitation, first pump-out and spin, second fill, rinse agitation, and final pump-out and spin

Process/Skill Questions:

F004: Describe fill functions in a normal cycle

Definition: Process should include the following:

- list elements of a fill functions

Process/Skill Questions:

F005: Describe agitation in a normal cycle

Definition: Process should include the following:

- list elements of an agitation in a normal cycle

Process/Skill Questions:

F006: Describe pump-out and spin functions in a normal cycle

Definition: Process should include the following:

- list elements of a pump-out and spin function in a normal cycle

Process/Skill Questions:

F007: Review guidelines for evaluating automatic washer malfunctions

Definition: Process should include the following:

- list guidelines for evaluating automatic washer malfunctions

Process/Skill Questions:

F008: Review in sequence, steps followed in validating repairs

Definition: Process should include the following:

- list steps followed in validating repairs

Process/Skill Questions:

F009: Troubleshoot a washer that will not fill with water

Definition: Process should include the following:

- check the obvious first
- check availability of proper water supply
- check voltage at mixing valve with VOM
- check for obstructions when mixing valve is energized but won't admit water
- check polarity on fill switch
- check temperature selection switch
- check timer
- check lid switch for proper contact

Process/Skill Questions:

F010: Troubleshoot a washer for improper water level or water temperature

Definition: Process should include the following:

- check reversal of hot and cold water hoses
- check quality of hot water supply
- check for faulty water level switch
- check for faulty thermal element in mixing valve as needed
- check for faulty temperature selection switch in control panel or timer
- check for faulty timer
- washer with spray rinse in the spin portion of rinse cycle
    - check for no cold water supply or kinked cold water hose
    - check for clogged inlet screen
    - check for defective cold water solenoid in the mixing valve
    - check for defective timer

Process/Skill Questions:

F011: Troubleshoot a washer that will not shut off

Definition: Process should include the following:

- check for timer malfunction on time-fill washers
- check water level/water pressure switch and replace if defective
- check for foreign particles in the mixing valve
- check for break or pinhole in air chamber or connecting tubing on pressure-filled models

Process/Skill Questions:

F012: Troubleshoot a washer that leaks water

Definition: Process should include the following:

- check for loose or cracked supply hoses
- check for loose drain hose
- run washer through normal cycle and replace hoses as required
- check for worn or damaged supply hose washers
- check for leaky gaskets
- check for cracked housing at outer tub, water pump, and mixing valve

Process/Skill Questions:

F013: Troubleshoot water that will not drain from washer

Definition: Process should include the following:

- check for kinked or clogged drain hose
- check for water pump problem
- check for loose belt at water pump
- check for faulty transfer or solenoid valve
- check for defective water pump
- check for a faulty timer

Process/Skill Questions:

F014: Troubleshoot a washer with a motor that will not run

Definition: Process should include the following:

- check power to machine
- check for faulty door/lid switch
- check for an overload device or other protective device in the circuit
- check for faulty timer
- check for a faulty motor

Process/Skill Questions:

F015: Troubleshoot a washer that will not agitate

Definition: Process should include the following:

- check for motor malfunction
- check timer for bad contacts
- check for faulty transmission
- check for broken linkage or other agitation control mechanism
- check for a broken wire in circuitry
- check for stripped splines in agitators

Process/Skill Questions:

F016: Troubleshoot a washer that will not spin

Definition: Process should include the following:

- check washer for agitation to eliminate motor as problem source
- check timer for defective contacts
- check door or lid switch
- check for faulty transmission
- check for broken linkage or other spin control mechanisms
- check for faulty water level switch
- check for broken wire in circuitry

Process/Skill Questions:

F017: Troubleshoot a washer that will not advance or shut off

Definition: Process should include the following:

- check timer contacts if timer will not advance
- check for defective timer or timer motor
- replace timer motor only with exact type motor removed
- check for break in circuitry wiring

Process/Skill Questions:

F018: Troubleshoot a washer that leaks oil

Definition: Process should include the following:

- check for leak in gearcase if oil leaks on floor
- check for faulty gearcase or transmission seal if oil leaks onto clothes in tub

Process/Skill Questions:

F019: Troubleshoot a washer that tears clothes

Definition: Process should include the following:

- confirm proper use of bleach by user
- check for broken agitator
- check for defective inner tub or basket

Process/Skill Questions:

F020: Troubleshoot a washer for additional miscellaneous problems

Definition: Process should include the following:

- adjust belt to clutch or replace clutch if machine spins slowly
- clean out clogged water pump if water does not recirculate during agitation
- tighten as needed or replace coupling if pump drive is defective
- clean out or replace valve or replace solenoid if distribution valve is defective
- replace timer motor or entire timer if timer will not advance to next cycle
- check for obstructions and free the shaft or replace time if timer shaft or knob is frozen
- replace control if water level switch is faulty
- reinforce weak floor or move washer, check for level, caution user not to overload or create unbalanced loads, or replace rubber cups on leveling feet if washer vibrates excessively
- check for damaged snubber or adjust or replace suspension bolts if tub vibrates excessively

Process/Skill Questions:

F021: Install an automatic washer

Definition: Process should include the following:

- describe procedure for installing an automatic washer

Process/Skill Questions:

F022: Troubleshoot a microprocessor control panel for typical malfunctions

Definition: Process should include the following:

- complete self-diagnostic test per service manual
- remove and replace control panel if required
- check touch pad for proper resistance readings
- check primary and secondary sides of transformer for resistance
- reinstall or replace transformer as required
- complete repair log noting problems

Process/Skill Questions:

DUTY G:
Demonstrate Knowledge of Automatic Dryers

Task:

G001: Discuss terms with definitions related to automatic dryers

Definition: Process should include the following:

- match terms and definitions related to automatic dryers

Process/Skill Questions:

G002: Match major components with their functions in an automatic dryer

Definition: Process should include the following:

- state function of major components related to automatic dryers

Process/Skill Questions:

G003: Arrange in order the steps in automatic dryer operation

Definition: Process should include the following:

- list operation steps related to automatic dryer operation

Process/Skill Questions:

G004: Explain functions of thermostats in automatic dryers

Definition: Process should include the following:

- list functions of thermostats in automatic dryers

Process/Skill Questions:

G005: Troubleshoot a dryer that will not run

Definition: Process should include the following:

- check plug
- check branch circuit control
- check faulty door switch
- check motor wiring and motor centrifugal switch
- check timer and timer circuitry

Process/Skill Questions:

G006: Troubleshoot a dryer that will run but not heat

Definition: Process should include the following:

- check for loose wires on terminals and run continuity check for broken wires
- check 240V power supply on electric dryers
- check defective thermostats
- check heat switch for wrong setting or basic function
- check timer and timer wiring and replace timer motor or entire timer as required
- check centrifugal switch if appropriate
- check open heater element and replace as required
- check gas supply and ensure gas supply valve is open
- check if pilot light is on as required, if not purge line as indicated on dryer plate directions and relight pilot
- check for defective solenoid coil in gas valve by testing coil for open circuit
- check for defective flame switch
- check for a malfunctioning igniter

Process/Skill Questions:

G007: Troubleshoot a dryer who's motor runs drum will not rotate

Definition: Process should include the following:

- check slipping or broken belt and adjust or replace
- check for loosed pulley and tighten pulley on motor shaft
- check for foreign object that may obstruct drum movement and remove
- check for frozen bearing and replace as required
- check for tension and adjust or replace

Process/Skill Questions:

G008: Troubleshoot a dryer that runs but will not shut off

Definition: Process should include the following:

- determine if one side of branch circuit control is tripped open
- check for defective timer and replace timer motor or timer as required

Process/Skill Questions:

G009: Troubleshoot a dryer that runs and heats but will not dry clothes

Definition: Process should include the following:

- check for clogged lint screen and clean as required
- check for a clogged exhaust vent
- check for incorrect heat or timer setting and reset as required
- check for leaky door seal and if door seal leaks air, replace

- check for leaky drum seals and replace as required

- check for fan or pulley loose on shaft and tighten as require to restore good air motion in drum
- check for defective operating thermostats, and if thermostats cycle too soon or too late, replace
- determine if cloths were too wet when placed into the drum – excessively wet cloths may indicate automatic washer problem

Process/Skill Questions:

G010: Troubleshoot automatic dryers with additional miscellaneous problems

Definition: Process should include the following:

- dryer repeatedly blows fuses or trips breaker
  - check wiring for bare spots that may touch frame
  - check for sagging drum causing heater element to tough housing
  - check heater element for foreign matter
- motor runs when door is open and timer fails to advance
  - check for a defective door switch and replace as required
  - check for dial that binds its too far out from control panel, relocate dial on timer shaft to eliminate binding
- drum inspection light is burned out
  - replace bulb
- dryer heats with door open or in OFF cycle
  - check centrifugal switch
  - check for malfunctioning heating element

Process/Skill Questions:

G011: Troubleshoot gas valves and igniters on gas dryers

Definition: Process should include the following:

- ensure gas is turned off
- determine if there is voltage to gas valve but no flame, replace entire valve as required
- run continuity test to determine if resistance is between 50 to 400 ohms, replace igniter if otherwise

Note: When installing a gas dryer or when relighting one that has been repaired, purge the gas line as follows:

- turn gas off
- loosen the connection between the shut-off valve and the burner
- turn gas on until you hear or smell gas at the loose connection, turn gas off, and tighten connection

Note: Purging clears air from the line and saves time relighting the pilot burner

Process/Skill Questions:

G012: Troubleshoot special gas dryer problems

Definition: Process should include the following:

- pilot burner goes out (only models with manually-lit pilots)
  - check for insufficient gas supply, low gas pressure, clogged pilot filter, or closed or partially closed gas supply valve
  - check for excessive carbon build-up on thermocouple and clean as required
  - check for a faulty thermocouple and replace as required
  - readjust pilot flame until faint yellow tip appears
  - check for a faulty ignition or reset valve and replace as required
  - check for excessive back drafts
- pilot burner does not light
  - check for closed or partially closed gas supply valve, a clogged pilot filter, or obstruction in gas supply line
  - check setting on pilot switch and reset as instructions direct
- pilot burner is okay but main burner does not light
  - check for insufficient gas supply, a partially closed gas supply valve, or obstruction in the gas supply line
  - check for defective safety thermostat and replace as required
  - check for incorrect air supply and readjust air shutter on the gas burner until a bright blue flame appears
  - check gas valve solenoid and replace solenoid as required or replace gas valve
- main burner cycles (comes on and goes off) too fast
  - check for loose connections at wiring terminals and tightens as required
  - check for faulty timer and replace timer motor or timer as required
  - check for faulty operating thermostat and replace as required
  - check safety thermostat for erratic cycling because of restricted air flow, clean lint or obstructions from dryer as required
  - check safety thermostat for proper operation and replace as required
- main burner goes out after lighting
  - check for low gas pressure, partially closed gas supply valve, or obstruction in gas supply
  - check primary air adjustment and adjust air shutter until bright blue flame appears at main burner
  - check for loose connections at terminals and tighten as required

Process/Skill Questions:

G013: Troubleshoot a microprocessor control board for typical malfunctions

Definition: Process should include the following:

- complete self-diagnostic test per service manual
- remove and replace control panel as required
- check touch pad for proper resistance readings
- check resistance on primary and secondary sides of transformer
- check voltage on primary and secondary sides of transformer
- reinstall or replace transformer as required
- complete repair log noting problem and actions taken

Process/Skill Questions:

G014: Install an automatic dryer

Definition: Process should include the following:

- inspect installation area
- complete electrical connections/grounding
- operate dryer to verify correct installation
- install and operate gas dryer
- instruct customer/instructor on safe operation and maintenance of dryer

Process/Skill Questions:

DUTY H:
Demonstrate Knowledge of Automatic Dishwashers

Task:

H001: Discuss terms with definitions related to automatic dishwashers

Definition: Process should include the following:

- list terms with definitions as they relate to automatic dishwashers

Process/Skill Questions:

H002: Describe major components and their functions in automatic dishwashers

Definition: Process should include the following:

- state major components and their functions to include timer, inlet valve, motor, heating element, pump, spray arms, filter, drain valve, door/lid switch, dispensers, and float switch

Process/Skill Questions:

H003: Arrange in order the typical steps in an automatic dishwasher cycle

Definition: Process should include the following:

- state each step in an automatic dishwasher cycle

Process/Skill Questions:

H004: Review special considerations for dishwasher installation

Definition: Process should include the following:

- list special considerations for dishwasher installation

Process/Skill Questions:

H005: Describe water problems associated with dishwashers

Definition: Process should include the following:

- list water problems associated with dishwashers

Process/Skill Questions:

H006: Review loading order in dishwasher operations

Definition: Process should include the following:

- list general rules of loading in dishwasher operations

Process/Skill Questions:

H007: Discuss common dishwasher misuses and their causes

Definition: Process should include the following:

- list common dishwasher misuses and their causes

Process/Skill Questions:

H008: Review guidelines for better dishwasher service

Definition: Process should include the following:

- state guidelines for better dishwasher service

Process/Skill Questions:

H009: Discuss guidelines for troubleshooting automatic dishwashers

Definition: Process should include the following:

- list guidelines for troubleshooting automatic dishwashers
  - check for proper 120V electrical power source
  - check for hot water supply of 140°F to 160°F and minimum water pressure of 15 psi
  - check for a faulty floor causing dishwasher to vibrate
  - check for improper ventilation
  - check for abusive practices to include improper detergent, improper loading, or other types of abuse
  - compare operating sequence of timer to schematic wiring diagram to systematically troubleshoot problems
  - use manufacturer's service chart for specific problems
  - look for leaks or broken parts, listen for parts binding, and generally use your senses and common sense to diagnose problems properly
  - check with customer to determine if shower or laundry use is depleting hot water supply

Process/Skill Questions:

H010: Describe methods for preventing mineral build-up in an automatic dishwasher

Definition: Process should include the following:

- list methods for preventing mineral build-up in an automatic dishwasher
  - check water at regular intervals for presence of white, brown, or yellow build-up in tub
  - add half a cup of citric acid crystals, two cups of distilled white vinegar, quarter teaspoon of oxalic acid crystals, or baking soda to the wash cycle (substance used determined by type mineral build-up)
  - verify water temperature is between140°F and 160°F
  - change detergent or mixture of detergent and conditioner

Process/Skill Questions:

H011: Install an automatic dishwasher under a counter

Definition: Process should include the following:

- check plumbing and electrical services
- install dishwasher to specifications
- perform final checks
- inform customer/instructor of operating and maintenance procedures

Process/Skill Questions:

H012: Troubleshoot malfunctions on an automatic dishwasher

Definition: Process should include the following:

- check door switch continuity
- check float switch continuity
- check water fill valve continuity
- check water fill valve filter screen
- check start relay continuity
- check heating element continuity
- check detergent dispenser continuity
- check timer

Process/Skill Questions:

H013: Inspect the seal on an automatic dishwasher

Definition: Process should include the following:

- remove spray arm, diffuser, and impeller
- remove and inspect pump and plate
- inspect, evaluate and replace as needed lower seal
- reassemble components in correct order

Process/Skill Questions:

DUTY I:
Demonstrate Knowledge of Garbage Disposals

Task:

I001: Discuss terms with definitions as they relate to garbage disposals

Definition: Process should include the following:

- review terms and definitions as they relate to garbage disposals

Process/Skill Questions:

I002: Discuss safety rules related to repair and operation of garbage disposals

Definition: Process should include the following:

- list safety rules related to repair and operation of garbage disposals

Process/Skill Questions:

I003: Match major components of a disposal with their functions.

Definition: Process should include the following:

- list components and their functions to include lower housing, upper housing, drive motor, flywheel, shredding ring, impeller, mounting flange, tailpiece, and insulation

Process/Skill Questions:

I004: Describe in order the steps in garbage disposal operations

Definition: Process should include the following:

- list steps in garbage disposal operations

Process/Skill Questions:

I005: Discuss importance of cold water flow in disposals

Definition: Process should include the following:

- identify effect cold water has on disposal material
- identity disposal parts effect by cold water

Process/Skill Questions:

I006: Identify common misuses of disposals that cause problems

Definition: Process should include the following:

- list five most common misuses of disposals that case problems

Process/Skill Questions:

I007: List items that can be placed into a garbage disposal

Definition: Process should include the following:

- state type items suitable for disposal

Process/Skill Questions:

I008: Discuss guidelines for handling a jammed garbage disposal

Definition: Process should include the following:

- state guidelines for handling a jammed garbage disposal
    - turn off disposer
    - turn on motor-reversing switch if available
    - insert an unjamming tool, and manually turn the impeller backwards for disposers without motor-reversing switch
    - run motor forward if possible to complete shredding obstruction causing jam
    - repeat previous procedure if necessary but extract obstruction with tongs in lieu of shredding

Process/Skill Questions:

I009: Discuss procedures for installing a garbage disposal

Definition: Process should include the following:

- check power supply to confirm voltage and frequency listed on motor nameplate
- ground disposer
- examine existing plumbing to ensure suitability for installation and compliance with local code
- install dedicated trap for disposer (not shared by other equipment)
- remove old grease trap if permitted by code and advise customer to clean trap every 90 days
- verify, if septic tank is used, that tank holds minimum of 500 gallon to assure proper function of disposer
- encourage customers with septic systems to avoid placing anything in disposer that isn't biodegradable

Process/Skill Questions:

I010: Discuss guidelines for troubleshooting garbage disposal malfunctions

Definition: Process should include the following:

- list guidelines for troubleshooting garbage disposal malfunctions
    - disconnect power before inserting any tool into disposer
    - confirm impeller is free to turn and unjam if obstructed
    - push reset button only after motor is allowed to cool
    - confirm 120V power supply is reaching motor because low line voltage will cause motor to overheat and stop
    - check for blown fuse
    - check for loose wires at terminals
    - disconnect power supply and check continuity of switches
    - check motor if switches appear functional
    - ensure power supply and disposer are grounded

Process/Skill Questions:

I011: Install a garbage disposal

Definition: Process should include the following:

- prepare sink and drain lines
- install sink mounting assembly
- attached disposer to sink
- make plumbing connections to local codes
- connect disposer/dishwasher
- make disposer electrical connections
- complete successful initial test run

Process/Skill Questions:

I012: Free a jammed garbage disposal

Definition: Process should include the following:

- unhook or lock out disposer electrical
- clear disposer of obstacle and allow to cool
- press restart button at correct time
- fill disposer with waste and run functional test

Process/Skill Questions:

DUTY J:
Demonstrate Knowledge of Trash Compactors

Task:

J001: Discuss terms related to trash compactors with their definitions

Definition: Process should include the following:

- match terms related to trash compactors with their definitions

Process/Skill Questions:

J002: Review characteristics of trash compactors

Definition: Process should include the following:

- list characteristics of trash compactors

Process/Skill Questions:

J003: Arrange in order the steps in a typical compactor cycle

Definition: Process should include the following:

- list steps in typical compactor cycle

Process/Skill Questions:

J004: Describe trash compactor electrical components and their characteristics

Definition: Process should include the following:

- list electrical components and their characteristics to include start switch, top limit and ram directional switch, drawer safety switch, drawer tilt switch, and drive motor

Process/Skill Questions:

J005: Review safe operation and service of trash compactors

Definition: Process should include the following:

- state safe operating procedures for trash compactors
- state safe servicing procedures for trash compactors

Process/Skill Questions:

J006: Discuss guidelines for properly loading a compactor

Definition: Process should include the following:

- list guidelines for proper loading of a compactor

Process/Skill Questions:

J007: Discuss common causes of failure in trash compactors

Definition: Process should include the following:

- identify common causes of failure in trash compactors

Process/Skill Questions:

J008: Discuss major wear problems with trash compactors

Definition: Process should include the following:

- list major wear problems with trash compactors to include motor burnout, power screw threads stripping, chain and belt breaks or go out of adjustment,

Process/Skill Questions:

J009: Review lubrications requirements for trash compactors

Definition: Process should include the following:

- identify type lubricant designed for high pressure applications
- identify type lubricant used on slide rollers on trash drawer

Process/Skill Questions:

J010: Review procedures for adjusting chains and belts

Definition: Process should include the following:

- list procedures for adjusting chains and belts

Process/Skill Questions:

J011: Review troubleshooting guidelines for trash compactors

Definition: Process should include the following:

- list guidelines for troubleshooting trash compactors
    - compactor will not start
    - compactor will not stop
    - compactor stops before end of cycle
    - compactor reverses too soon
    - drive screw runs the wrong way

Process/Skill Questions:

J012: Troubleshoot a noisy compactor

Definition: Process should include the following:

- check power drive screw nuts to determine if they are off top of threads when a noise is accompanied by a thumping sound at the beginning of start cycle
- troubleshoot noise during ram travel
    - check chain tension
    - check lubrication
    - check worn power screw drive bearings
    - check worn drive gear assembly
    - check worn motor drive gear
    - check worn thrust bearings
    - check loose or worn power drive screw nuts
- troubleshoot noise during bottom of cycle
    - check worn bumpers
    - check loading down

Process/Skill Questions:

J013: Troubleshoot other compactor problems

Definition: Process should include the following:

- troubleshoot complaint of unpleasant odor in or around compactor
    - check for garbage outside container
    - clean inside of drawer as needed
    - clean inside cabinet as needed
    - replace deodorizer
    - remove trash bag
- troubleshoot trash bags tangled in ram
    - check for properly installed trash bag
    - check for correct type garbage bag

Process/Skill Questions:

J014: Review items to avoid placing in a trash compactor

Definition: Process should include the following:

- list items to avoid placing in a trash compactor

Process/Skill Questions:

J015: Use schematics to determine operating conditions on a trash compactor

Definition: Process should include the following:

- identify correct schematic for model trash compactor
- define symbols used on schematic
- match elements of schematic to corresponding parts and cycles on trash compactor to include the start windings, start switch, run switch, drawer tilt switch, and indicator light

Process/Skill Questions:

J016: Install an under-counter trash compactor to specifications

Definition: Process should include the following:

- check electrical requirements
- install compactor to specifications
- confirm availability of operating literature

Process/Skill Questions:

J017: Test the drive motor on a trash compactor to determine its operational condition

Definition: Process should include the following:

- test motor run winding
- test motor start windings
- test centrifugal switch
- test motor clockwise/counterclockwise function

Process/Skill Questions:

J018: Troubleshoot a trash compactor for typical malfunctions

Definition: Process should include the following:

- troubleshoot compactor that will not run
- troubleshoot ram that will not return to home position
- perform preventative maintenance on trash compactor

Process/Skill Questions:

DUTY K:
Demonstrate Knowledge of Gas Ranges and Ovens

Task:

K001: Discuss terms and their definitions related to gas ranges and ovens

Definition: Process should include the following:

- match terms and their definitions as they relate to gas ranges and ovens

Process/Skill Questions:

K002: Review basics of gas heating

Definition: Process should include the following:

- list basics related to gas heating to include principles of BTU, gas rating, gas burner design and BTUs

Process/Skill Questions:

K003: Discuss characteristics and safety considerations of natural and bottled gas

Definition: Process should include the following:

- describe characteristics of natural and bottled gas
- describe safety considerations of natural and bottled gas

Process/Skill Questions:

K004: Review operation of a gas range top burner

Definition: Process should include the following:

- list operations associated with gas range top burners to include gas regulator valve, manifold, gas control valve, spud, orifices, venturi, flash port, flash tube, and pilot flame

Process/Skill Questions:

K005: Discuss orifice settings

Definition: Process should include the following:

- review issues and considerations that impact orifice settings
- review universal orifices and settings

Process/Skill Questions:

K006: Explain primary and secondary air

Definition: Process should include the following:

- review function and flow of primary and secondary air flow

Process/Skill Questions:

K007: Review byproducts of combustion

Definition: Process should include the following:

- list byproducts of combustion
- state ventilation issues related to byproducts of combustion

Process/Skill Questions:

K008: Discuss solutions for burner combustion problems

Definition: Process should include the following:

- review solutions if flame is leaping off the burner
- review solutions if flame burns yellow and produces soot
- review solutions if flame looks lazy and seems to float away from burner
- review solutions to primary and secondary air problems

Process/Skill Questions:

K009: Review types of gas burners and applications of each

Definition: Process should include the following:

- list type gas burners and applications to include drilled-ring/circular, drilled–pipe/star, drilled-pipe/oval, straight line, and special configurations

Process/Skill Questions:

K010: Review types of oven ignition systems and their characteristics

Definition: Process should include the following:

- list types of ignition systems and their characteristics to include automatic ignition, semi-automatic ignition, and manual ignition

Process/Skill Questions:

K011: Explain how a gas oven works

Definition: Process should include the following:

- review operation of a gas over from ignition to termination

Process/Skill Questions:

K012: List types of oven thermostats and their characteristics

Definition: Process should include the following:

- state characteristics of a hydraulic thermostat
- state characteristics of a pneumatic thermostat

Process/Skill Questions:

K013: Describe safety valves and their functions

Definition: Process should include the following:

- review types of safety valves
- review function of safety valves

Process/Skill Questions:

K014: Review misuses of gas stoves

Definition: Process should include the following:

- list misuses of gas stoves

Process/Skill Questions:

K015: Discuss considerations for ovens with upper and lower burners

Definition: Process should include the following:

- review air supply issues
- review function of aeration and snorkel tubes

Process/Skill Questions:

K016: Explain how self-cleaning ovens work

Definition: Process should include the following:

- review byproducts produced by self-cleaning process
- review the process of pyrolysis
- review venting of byproducts of self-cleaning process

Process/Skill Questions:

K017: Describe special safety features of self-cleaning ovens

Definition: Process should include the following:

- describe function of metal-mesh protection screen
- review function and oven door latches
- review action of internal thermometer and oven door latches

Process/Skill Questions:

K018: Discuss safety requirements for gases

Definition: Process should include the following:

- explain purpose of individual safety guidelines followed with gas

Process/Skill Questions:

K019: Describe flexible connectors and their uses

Definition: Process should include the following:

- list types of flexible connectors
- list characteristics of each type flexible connector
- describe type fittings used with flexible connectors

Process/Skill Questions:

K020: Review requirements for gas supply lines

Definition: Process should include the following:

- review piping, gas supply lines and feeder lines
- list material used when making joints

Process/Skill Questions:

K021: Explain functions of electrical circuits on gas ovens

Definition: Process should include the following:

- state function of electrical circuits on self-cleaning ovens

Process/Skill Questions:

K022: Discuss typical functions of circuits on gas ovens

Definition: Process should include the following:

- describe function of energized circuits for BAKE operation
- describe function of energized circuits for TIMED BAKE operation
- describe function of energized circuits for CLEAN operation
- describe function of energized circuits for LOCK operation
- describe function of energized circuits for UNLOCK operation

Note: During opening and closing of the thermostatic contacts, the heating element n the smoke eliminator is energized, and smoke eliminator fan blows byproducts of combustion into the flue

Process/Skill Questions:

K023: Match gas range complaints with recommended troubleshooting

Definition: Process should include the following:

- pilot light is out and will not light or will not stay lit
    - adjust pilot light
    - adjust burner flame
    - check safety valve or thermocouple, replace as required
- top burner will not light or flame is too high or too low
    - check top burner pilot light
    - check flash tube to pilot for position or obstruction
    - reposition burner
    - unclog flash port
    - unclog burner
    - check primary air
    - check orifice size
- flame jumps off burner or flame is smoky
    - check volume of primary air flow through shutter

- oven is not heating properly
    - check oven thermostat
    - check for bypass gas supple problems
    - check calibration of oven thermostat
    - adjust burner
    - check gas pressure
- oven sweats
    - check preheating (oven door may need to be left open)
    - check oven thermostat temperature
    - check vent for clog
- there is odor of gas around range
    - check for gas leak in connections along supply lines
    - ensure oven burners are getting enough primary air
    - check if oven pilot is touching burner

Process/Skill Questions:

K024: Discuss gas pressure drops and their causes

Definition: Process should include the following:

- describe various reasons for gas pressure drops
- describe various signs of gas pressure drops

Process/Skill Questions:

K025: Discuss manometer selection and use

Definition: Process should include the following:

- describe types of manometers and their differences
- review function of manometers
- review use of manometers

Process/Skill Questions:

K026: List common solutions to baking problems

Definition: Process should include the following:

- list solutions for baked goods burned on top
- list solutions for baked goods burned on one side
- list solutions for baked goods burned on bottom
- list solutions for baked goods that are soggy

Process/Skill Questions:

K027: Discuss guidelines for customer service calls

Definition: Process should include the following:

- review guidelines commonly followed for customer service calls

Process/Skill Questions:

K028: Determine voltage and resistance readings on a self-cleaning gas oven set for a bake operation

Definition: Process should include the following:

- discuss the use of a VOM and schematics in determining various voltage and resistance readings on a self-cleaning gas oven set for a bake operation

Process/Skill Questions:

K029: Determine voltage and resistance readings on a self-cleaning gas oven set for a timed bake operation

Definition: Process should include the following:

- discuss the use of a VOM and schematics in determining various voltage and resistance readings on a self-cleaning gas oven set for a timed bake operation

Process/Skill Questions:

K030: Determine voltage and resistance readings on a self-cleaning gas oven set for a cleaning operation

Definition: Process should include the following:

- discuss the use of a VOM and schematics in determining various voltage and resistance readings on a self-cleaning gas oven set for a cleaning operation

Process/Skill Questions:

K031: Determine voltage and resistance readings on a self-cleaning gas oven during lock and unlock

Definition: Process should include the following:

- discuss the use of a VOM and schematics in determining various voltage and resistance readings on a self-cleaning gas oven during lock and unlock

Process/Skill Questions:

K032: Install a gas range level and leak free with all burners properly adjusted

Definition: Process should include the following:

- inspect installation area for safety and air supply
- make all fittings and install cut-off valve
- check range for level
- check gas supply to range and oven for leaks
- check range and oven burners and verify lit pilot

Process/Skill Questions:

K033: Check gas oven temperature for proper oven thermostat settings

Definition: Process should include the following:

- position temperature probe
- check oven thermostat and calibrate to 250°F
- check oven thermostat and calibrate to 300°F

Process/Skill Questions:

K034: Recalibrate a gas oven thermostat to correct settings

Definition: Process should include the following:

- set up equipment and select option
- calibrate D-stem and pin type thermostat
- calibrate thermostat with recessed calibration screw
- calibrate thermostat with dial shaft adjustment

Process/Skill Questions:

K035: Remove, disassemble, clean, lubricate, and reassemble a standard gas burner valve

Definition: Process should include the following:

- remove control knob and front panel
- access valve stem and remove
- clean stem and stem interior
- apply graphite lubricant around stem
- reassemble burner valve

Process/Skill Questions:

DUTY L:
Demonstrate Knowledge of Electric Ranges and Ovens

Task:

L001: Discuss terms with their definitions related to electric ranges and ovens

Definition: Process should include the following:

- match terms with their definitions related to electric ranges and ovens

Process/Skill Questions:

L002: State electrical requirements for hooking up an electric range

Definition: Process should include the following:

- list electrical requirements for hooking up an electric range to include 240V at 50amps, only three or four prong straight-bladed plug (per NEC)

Process/Skill Questions:

L003: Review basics of electric cooking

Definition: Process should include the following:

- list basics of electric cooking to include heating element rating and composition, combustion byproducts and self-cleaning, and gas vs. electric energy

Process/Skill Questions:

L004: Discuss electric surfaces and oven heating elements

Definition: Process should include the following:

- review methods of attachment of surface heating elements
- list types of heating elements of both surface and oven

Process/Skill Questions:

L005: Differentiate between types of heat controls for surface heating elements.

Definition: Process should include the following:

- review type and characteristics of step-type controls for surface heating elements

Process/Skill Questions:

L006: List types and characteristics of electric oven thermostats

Definition: Process should include the following:

- list type and characteristics of electric oven thermostats to include bellows, bimetallic, and diaphragm types

Process/Skill Questions:

L007: Recalibrate electric oven thermostats

Definition: Process should include the following:

- recalibrate thermostats only if required (thermostats are calibrated at the factory)
- recalibrate by turning small screw in face of thermostat left to increase temperature or right to decrease temperature
- recalibrate newer ovens by simple knob adjustment
- conduct second oven temperature test to assure new settings are correct

Process/Skill Questions:

L008: Discuss electric oven self-cleaning operations

Definition: Process should include the following:

- list actions that occur when each of the following actions occur
    - push CLEAN button on selector switch
    - set control knob on clock timer to LIGHT CLEAN or HEAVY CLEAN
    - push LOCK lever to right
    - apply 12volt current to Hot Wire Relay on back of oven thermostat
    - increase oven temperature to 550°F
    - increase oven temperature range 825°F to 1100°F
    - decrease oven temperature to 825°F
    - programmed time expires
    - oven cools 250°F to 325°F

Process/Skill Questions:

L009: Match components with their functions in a self-cleaning cycle

Definition: Process should include the following:

- review function of self-cleaning components in self-cleaning cycle to include metal mesh over window screen, lock latch, and smoke eliminator

Process/Skill Questions:

L010: Troubleshoot an electric ranges

Definition: Process should include the following:

- oven will not heat or oven will not turn off
    - check for blown fuse
    - check for loose wire
    - check selector switch
    - check timer
    - check thermostat
    - check baking element
    - check control circuitry
- surface unit will not heat, is always on high, or has too much heat on low setting
    - check for blown fuse

- check for loose or incorrect connection
- check for opening in element
- check for bad surface unit switch

- timer malfunctions
  - check for loose connections or wrong connections (check wiring schematic)
  - check for bad timer motor
  - check for bad timer

- oven door does not close properly
  - check for worn pins or hinge brackets
  - check oven door seal or misalignment

- self-cleaning function does not operate
  - check back and broil circuitry
  - check selector switch or oven thermostat
  - check for blown fuse
  - check safety interlock system

Process/Skill Questions:

L011: Check surface units from an electric range for proper resistance

Definition: Process should include the following:
- remove surface unit
- inspect surface unit
- complete VOM resistance readings

Process/Skill Questions:

L012: Check the self-cleaning function on an electric oven

Definition: Process should include the following:
- prepare oven for self-clean cycle
- record self-clean cycle start and finish
- verify function of smoke eliminator

Process/Skill Questions:

L013: Check step-type and infinite electric range switches for continuity

Definition: Process should include the following:
- check all switches for proper cycling
- check all switches for full 360° operation
- use schematics as needed

Process/Skill Questions:

DUTY M:
Demonstrate Knowledge of Microwave Ovens

Task:

M001: Discuss terms and definitions related to microwave ovens

Definition: Process should include the following:

- match terms with their definitions related to microwave ovens

Process/Skill Questions:

M002: Review fundamentals of microwave operations and the science involved

Definition: Process should include the following:

- list fundamentals of microwave operations and the science involved

Process/Skill Questions:

M003: Discuss microwave oven controlling standards with their controlling agencies

Definition: Process should include the following:

- match controlling agencies and their standards to include the FCC, DHS, and UL
- review individual FCC microwave standards

Process/Skill Questions:

M004: List performance standards for microwave ovens

Definition: Process should include the following:

- identify performance standards for microwave ovens and their impact on performance

Process/Skill Questions:

M005: Match basic components with their functions in a microwave oven

Definition: Process should include the following:

- list basic components to include microwave source, transmission device, distribution device, oven cavity, and interlock system

Process/Skill Questions:

M006: Discuss magnetron structure and operation

Definition: Process should include the following:

- list components of a magnetron to include the outer, middle, and inner cylinders
- review the operation of a magnetron

Process/Skill Questions:

M007: Discuss significance of microwave reflection

Definition: Process should include the following:

- review interaction of metal surfaces and microwaves
- review arching and resulting consequences in microwave ovens

Process/Skill Questions:

M008: Discuss significance of microwave transmission

Definition: Process should include the following:

- list type materials which enhance microwave transmissions

Process/Skill Questions:

M009: Discuss significance of microwave absorption

Definition: Process should include the following:

- define absorption and its significance in microwave cooking
- review impact that shape and positioning of food has on absorption

Process/Skill Questions:

M010: Explain how microwaves cook food

Definition: Process should include the following:

- review internal actions occurring within food as it is cooked by microwaves

Process/Skill Questions:

M011: Review procedures for installing a microwave oven

Definition: Process should include the following:

- list step by step procedures followed when installing a microwave oven to include an operational check

Process/Skill Questions:

M012: List rules for preventative maintenance on microwave ovens

Definition: Process should include the following:

- list rules for preventative maintenance on microwave ovens to include cleaning suggestions and maintaining proper ventilation

Process/Skill Questions:

M013: Review major microwave oven components and their functions

Definition: Process should include the following:

- list major microwave oven components and their functions to include the power transformer, voltage-doubler, magnetron, antenna, waveguide, and stirrer assembly

Process/Skill Questions:

M014: Review standards for RF leakage test instruments

Definition: Process should include the following:

- list standards for RF leakage test instruments and their purpose
- define function of spacer cones

Process/Skill Questions:

M015: List operating controls and their functions

Definition: Process should include the following:

- list operating controls and their functions to include interlock switches, interlock monitor, timer, start/stop controls, thermal protectors, cook relay, controller, and triac

Process/Skill Questions:

M016: Describe type motors used in microwave ovens and their functions

Definition: Process should include the following:

- list type motors used in microwave ovens and their functions to include the blower motor, stirrer motor, and turntable motor

Process/Skill Questions:

M017: Explain function of door seals as part of the construction of a microwave oven

Definition: Process should include the following:

- state functions of door seals as part of the construction of a microwave oven
- list types of seals to include capacitive seals, choke seals, absorbent seals, and door seals

Process/Skill Questions:

M018: List printed materials required to service microwave ovens

Definition: Process should include the following:

- list technical material required for microwave service to include nameplate, service manual, service bulletins, parts catalog, and wiring schematics

Process/Skill Questions:

M019: Troubleshoot a microwave oven

Definition: Process should include the following:

- follow a logical sequence for troubleshooting a microwave oven to include the following:
  - complete pre-service inspection
    - check interlock operations and proper door closing
    - examine seals and door surfaces for signs of arcing, wear, or damage
    - check door hinges
    - examine oven wrap and all exterior surfaces
    - check magnetron and waveguide for proper alignment
    - check stirrer assembly
  - check troubleshooting procedures in service manual
  - check technical materials to ensure they reflect engineering changes and are otherwise up to date
  - perform a proper wiring schematic and circuit diagnosis
  - perform components tests in order
  - use parts catalog that specifically lists parts and components for oven being repaired
  - perform an RF leakage test after repairs are completed and leave a leakage test tag on the oven
  - run oven through a complete operating cycle

Process/Skill Questions:

M020: Discuss safety requirements for microwave oven service

Definition: Process should include the following:

- review commonly accepted safety practices followed when services microwave ovens
- review commonly accepted post-service safety practices

Process/Skill Questions:

M021: Perform Circuit Diagnosis

Definition: Process should include the following:

- use correct schematic for make and model of microwave oven being repaired
- begin troubleshooting at circuit breaker and proceed through circuitry identifying components or conditions that could cause problem
- perform circuit diagnosis of microwave oven in IDLE condition
- perform circuit diagnosis of microwave oven in COOK condition to troubleshoot the following problems:
  - oven appears to operate normally, but continues to heat on HIGH
  - timer does not advance, but other operations are normal
  - cook indicator light does not illuminate, but other operations are normal
  - stirrer blade does not rotate, but other operations are normal

- blower motor does not operate, but other operations are normal
- cavity light stays on at the end of cook cycle
- oven appears to operate normally, but heats very slowly
- oven appears to operate normally, but does not heat at all

- perform circuit diagnosis of microwave oven in VARI-COOK condition to troubleshoot the following problems:
  - cavity light illuminates with door open, but when door is closed, cavity light goes off and no components operate
  - cavity light illuminates, but timer and other components do not operate

Process/Skill Questions:

M022: Test the interlock system on microwave oven for safe operation

Definition: Process should include the following:

- check major electronic components located between cabinet and cavity walls
- check door, door gasket, and over surface
- perform operational check of interlock system

Process/Skill Questions:

M023: Check an RF leakage test meter and check a microwave oven for RF leakage

Definition: Process should include the following:

- confirm proper operation of test equipment
- prepare oven with load for proper testing
- take readings at strategic interfaces
- record all readings on RF leakage chart
- conduct testing following all safety procedures

Process/Skill Questions:

M024: Clean and deodorize a microwave oven

Definition: Process should include the following:

- prepare lemon/water cleaner and place in oven
- allow cleaner to boil for six minutes
- wipe over clean and inspect

Process/Skill Questions:

M025: Discharge a capacitor

Definition: Process should include the following:

- prepare oven for capacitor testing
- position resistor leads
- discharge capacitor

Process/Skill Questions:

M026: Check stirrer blade rotation and remove and disassemble a stirrer system

Definition: Process should include the following:

- perform visual check of stirrer system
- discharge capacitor
- prepare oven for removal of stirrer system
- remove stirrer system and inspect for wear
- reassemble stirrer system using proper sealant

Process/Skill Questions:

M027: Replace and adjust a microwave oven door assembly

Definition: Process should include the following:

- discharge capacitor
- install new door and adjust interlock
- perform RF leakage test to verify proper installation

Process/Skill Questions:

M028: Conduct power tests on a microwave oven to check for temperature rise under full power

Definition: Process should include the following:

- prepare initial water temperature test
- complete 63 second test and record results
- verify temperature rise and record results

Process/Skill Questions:

M029: Test and replace high voltage components when an oven produces little or no heat

Definition: Process should include the following:

- discharge capacitor
- check and replace capacitor as needed
- check and replace diode as needed
- check and replace magnetron as needed
- check and replace power transformer as needed

Process/Skill Questions:

M030: Remove a blower motor and transformer and remove and reinstall a magnetron

Definition: Process should include the following:

- discharge capacitor
- remove blower motor, housing duct, transformer, and diode
- remove and reinstall magnetron
- reinstall blower assembly
- perform RF leak test and operational check of oven

Process/Skill Questions:

M031: Check the interlock switch module on a microwave oven

Definition: Process should include the following:

- discharge capacitor
- check continuity per Function Test Chart
- record and evaluate findings

Process/Skill Questions:

M032: Test and replace magnetron and cavity thermal protectors

Definition: Process should include the following:

- discharge capacitor
- access and test magnetron and cavity thermal protectors
- replace as required magnetron and cavity thermal protectors

Process/Skill Questions:

M033: Test and replace a low voltage transformer and a triac module

Definition: Process should include the following:

- discharge capacitor
- access and check low voltage transformer
- access triac module and check for short
- check triac module for open
- remove and/or replace low voltage transformer and triac

Process/Skill Questions:

M034: Test a temperature probe and probe jack

Definition: Process should include the following:

- discharge capacitor
- assess temperature probe and probe jack and test
- replace probe and probe jack as required

Process/Skill Questions:

M035: Test and replace an oven timer and controller

Definition: Process should include the following:

- discharge capacitor
- test oven timer
- test controller
- remove/replace oven timer and controller

Process/Skill Questions:

M036: Remove, test and replace a control board

Definition: Process should include the following:

- discharge capacitor
- remove control panel
- test touch panel and replace as required

Process/Skill Questions:

M037: Test a control circuit board

Definition: Process should include the following:

- discharge capacitor
- complete self diagnostic test
- note trouble areas

Process/Skill Questions:

M038: Test a cook relay

Definition: Process should include the following:

- discharge capacitor
- complete test set-ups per specifications
- record findings

Process/Skill Questions:

M039: Test and replace a turntable motor

Definition: Process should include the following:

- discharge capacitor
- test turntable and replace as required

Process/Skill Questions:

DUTY N:
Demonstrate Knowledge of Refrigeration Principals and Perform Refrigerator Diagnosis In Accordance With EPA Regulations

Task:

N001: Discuss heat as it relates to the principles of refrigeration

Definition: Process should include the following:

- define heat quantity
- define heat intensity
- define heat movement
- define latent heat
- describe latent heat
- list methods of heat transfer
- identity heat movement and methods of heat transfer in the refrigeration process
- describe heat movement and the various methods of heat transfer
- describe the difference between heat quantity and heat intensity

Process/Skill Questions:

N002: Differentiate between gauge and absolute pressures

Definition: Process should include the following:

- define gauge pressure
- define absolute pressure
- state methods of obtain gauge and absolute pressure

Process/Skill Questions:

N003: Describe Charles Law

Definition: Process should include the following:

- list principles of Charles Law
- identify principles of Charles Law at work in the refrigeration process

Process/Skill Questions:

N004: Describe matter and changes of state

Definition: Process should include the following:

- identify the three states of matter
- list causes of change in the state of matter
- define pressure temperature
- describe the pressure temperature relationship during change of state

Process/Skill Questions:

N005: Discuss refrigerant

Definition: Process should include the following:

- identify qualities of an ideal refrigerant
- describe how refrigerants absorb and release heat

Process/Skill Questions:

N006: Describe the refrigeration cycle

Definition: Process should include the following:

- review each element of the refrigeration cycle
- describe the relationship between elements

Process/Skill Questions:

N007: Understand the electrical theory of operation of a refrigerator.

Definition: Process should include the following:

Process/Skill Questions:

N008: Discuss the various electrical components that are found in a typical refrigerator.

Definition: Process should include the following:

- list electrical components and their characteristics found in a typical refrigerator
- define function of each component

Process/Skill Questions:

N009: Install a typical refrigerator, ice maker, water line, and level

Definition: Process should include the following:

- Describe in sequence, steps followed to install a typical refrigerator, icemaker, water line and level.

Process/Skill Questions:

N010: Diagnose and repair electric failures in a refrigerator using a Voltmeter, Ohmmeter, Ammeter, and Wattmeter.

Definition: Process should include the following:

- Discuss basic troubleshooting procedures followed in diagnosing electrical failures in a refrigerator as defined in the maintenance manual
- Review electrical schematic for brand and model of unit being diagnosed

Process/Skill Questions:

N011: Diagnose and repair common refrigerator malfunctions

Definition: Process should include the following:

- Discuss basic troubleshooting procedures followed in diagnosing common refrigerator performance problems as defined in the maintenance manual

Process/Skill Questions:

SkillsUSA
Task Definitions

DUTY A: **Self - Improvement**
Task:
A001: Complete a self-assessment and identify individual learning styles *Definition:* Process should include the following: • Identify and list individual strengths. • Identify and list areas in need of improvement. Process/Skill Questions
A002: Discover self-motivation techniques and establish short-term goals *Definition:* Process should include the following: • Develop a list of short-term goals. • Discuss ways to change or improve lifestyle appearance and behavior. Process/Skill Questions
A003: Determine individual time-management skills *Definition:* Process should include the following: • Prepare and keep a time journal. • Discuss ways to improve time management skills. Process/Skill Questions
A004: Define future occupations *Definition:* Process should include the following: • Search internet for career opportunities within specified fields of study. • Prepare presentation on a specified career area. Process/Skill Questions
A005: Develop awareness of cultural diversity and equity issues *Definition:* Process should include the following: • Research a tradition modeled by individual's family. • Develop personal philosophy statements regarding gender equity. Process/Skill Questions

A006: Define the customer

Definition: Process should include the following:

- Differentiate between External and Internal customers
- Discuss factors which contribute to poor customer relationships.

Process/Skill Questions

A007: Recognize benefits of doing a community service project

Definition: Process should include the following:

- Discuss and list ways to become involved in the community
- Develop a community service project.

Process/Skill Questions

A008: Demonstrate effective communication with others

Definition: Process should include the following:

- Identify and list personal barriers to listening.
- Develop personal plan to overcome barriers to listening.

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize experience of job shadowing activity.

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

- Identify parts of a portfolio
- Design a personal employment portfolio

Process/Skill Questions

A011: List proficiency in program competencies

Definition: Process should include the following:

- Complete an interpersonal competency assessment.

Process/Skill Questions

DUTY B:
Civic, Social and Business Awareness

Task:

B001: Measure/modify short-term goals

Definition: Process should include the following:

- Discuss steps to pursue short-term goal(s)

Process/Skill Questions

B002: Identify stress sources

Definition: Process should include the following:

- List personal sources of stress.
- Discuss techniques to cope with individual sources of stress.

Process/Skill Questions

B003: Select characteristics of a positive image

Definition: Process should include the following:

- Discuss actions and traits that lead to a positive image.
- Discuss actions and traits that lead to a negative image.

Process/Skill Questions

B004: Demonstrate awareness of government, professional organizations and trade unions

Definition: Process should include the following:

- Identify state governor, legislators, and senators.
- Identify professional organizations pertaining to specific career areas.

Process/Skill Questions

B005: Apply team skills to a group project

Definition: Process should include the following:

- Form a team to develop a class project.

Process/Skill Questions

B006: Observe and critique a meeting

Definition: Process should include the following:

- Attend a formal meeting held within the community
- Critique the attended meeting.

Process/Skill Questions

B007: Demonstrate business meeting skills

Definition: Process should include the following:

- List and discuss the basic rules to ensure an orderly and business-like meeting
- Role-play appropriate meeting skills

Process/Skill Questions

B008: Demonstrate social etiquette

Definition: Process should include the following:

- Role-play appropriate social behavior
- Differentiate between good and bad manners.

Process/Skill Questions

B009: Complete survey for employment opportunities

Definition: Process should include the following:

- Gather information on a particular employment opportunity of interest.
- Conduct internet search of a specific career area.

Process/Skill Questions

B010: Review a professional journal and develop a 3 to 5 minute presentation

Definition: Process should include the following:

- Develop a presentation on the content, purpose, and distribution of a particular professional journal

Process/Skill Questions

B011: Identify customer expectations

Definition: Process should include the following:

- List and discuss customer expectations.
- Discuss consequences of unmet customer expectations.

Process/Skill Questions

B012: Complete a job application

Definition: Process should include the following:

- Obtain a job application from various businesses in the community
- Conduct a mock job interview.

Process/Skill Questions

B013: Identify a mentor

Definition: Process should include the following:

- Define mentor.
- Discuss ways in which a mentor can help an individual meet career goals.

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop employment portfolio

Process/Skill Questions

B015: Explore supervisory and management roles in an organization

Definition: Process should include the following:

- Examine an organizational chart
- Discuss responsibilities of managers and supervisors

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

B017: Evaluate your proficiency in program competencies

Definition: Process should include the following:

- Define task and competency
- List competencies associated with a specified career area.

Process/Skill Questions

Technical And Professional Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general "literacy."

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which vocational-technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most vocational-technical programs.

Using The Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
    - must be easy to implement
    - must stand alone

- do not need to be taught in a particular order
- must be open-ended enough to be useful for any technical/vocational program.

- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and vocational instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- "*Need-to-know" assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform ____ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.

- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at www.dol.gov.
- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit www.osha.gov.

- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see www.mavcc.org.

ACADEMIC STANDARDS FOR READING AND WRITING
Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	**Classroom Applications to Industry**
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding reading and writing.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
Answer **simple comprehension or recall questions from a lecture or from written material.**	Provide 2 examples of workplace materials* on students' reading level. With the first, allow students to read information and then answer brief recall questions. With the second example, read aloud the material but do not give a handout. Ask brief recall questions. Compare the differences…how do students retain information better—orally or visually? Discuss learning styles and impact on the job.
Follow, *Give* **oral instructions.**	Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.

Follow, *Give* **written instructions.**	Using a short list of instructions for a hands-on task, have students give written instructions to a partner or group. Rate the effectiveness of the speaker.
Show **the difference between relevant and irrelevant details.**	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
Sort **objects based on x number of criteria.**	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
Recognize, *Identify* **technical vocabulary.**	Using workplace materials*, highlight technical vocabulary terms. Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
Read **aloud.**	Read aloud from workplace materials* in groups or individually.
Identify, *Explain* **symbols, abbreviations and acronyms relevant to subject area.**	Using workplace materials*, highlight symbols, abbreviations, and acronyms. Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, *Use* **rules of grammar, usage, spelling, punctuation.**	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*. Correct the mistakes.
Discuss **uses and purposes of a variety of workplace communication tools.**	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
Duplicate **process demo by instructor**	Using a workplace process, demonstrate steps

	to complete and have students perform individually or in groups.
Notice, *Apply* **word analysis techniques.**	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) [1]
Match **parts from photographs or diagrams to actual objects.**	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
Read **for main ideas and for details.**	Use a graphic organizer[1] to show main ideas and supporting details.
Distinguish **between fact, opinion, and inference.**	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
Distinguish **between rows and columns;** *identify* **a cell as a block where a row and column intersect.**	Using charts or tables from workplace materials*, discuss the reasons for this format. Identify the quantity in a particular cell.
Select, *Use* **appropriate resources and reference tools.**	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia. List reasons for choosing one reference tool over another. Use reference tools to answer questions related to industry or current events.
Paraphrase **written or oral material into summary form.**	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson. Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

Interpret, *Fill out/complete* **forms and records.**	Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory). Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner. Create a form or document to be used in a workplace process.
Use, *Develop* **a process for remembering details.**	Use pneumatic devices to organize and remember details. Pneumatic devices[1] include Semantic Maps, Thought Webs, and other creative tools to organize thinking.
Proofread, *Correct* **mistakes in written drafts.**	Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage. Correct mistakes in written drafts.
Examine **different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).**	Gather samples of workplace materials*. Identify each by type. Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.
Understand **the writing process.**	In order to apply the writing process, create a workplace communication tool to be used for a specific purpose. Prewrite: Brainstorm, gather facts, or do research to create a business letter, memo, report, brochure, proposal, schematic, map, or diagram. Identify the audience.

	Determine the purpose of the document. Write: Create a first draft. Revise and Edit: Make changes to ensure accuracy. Look at the writing from a different point of view. Shorten or make more concise where possible. Use white space, bold print and other formatting details to make the document easy-to-read. Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.) Publish the final draft.

Identify, *Create* **sentences of different types.**	Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses). Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).
Identify, *Use* **contractions correctly.**	Using workplace materials*, locate contractions (e.g., isn't, I'll). Identify misuses of contractions. Write a short list of directions relating to an industry process and use as many contractions as possible.
Identify, *Use correctly* **commonly misspelled words.**	Using a list of commonly misspelled words[1], locate errors in the media (newspaper articles, Internet sites, magazines.) Ask each student to identify his problem words from the list. Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions). Give short weekly quizzes focusing on 5 words per week. Award bonus points.
Identify, *Use* **correctly the English irregular verbs.**	From a list of irregular verbs, review the uses of each. Ask each student to identify his problem irregular verbs from the list. Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.
Identify, *Use* **Signal Words and other cues to improve writing.**	Use a list of Signal Words[1] and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention.)

	Examples: Signal Words sowing emphasis: Most of all, It should be noted, Of course Signal Words showing a conclusion: Lastly, In summary, Finally Identify common signal words in workplace writing, especially in sequenced lists. Write a list of work instructions using signal words.
Identify **components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.**	Label the parts of a workplace document.
Place **steps in proper sequence.**	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
Analyze **cause and effect.**	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
Determine **missing information.**	Locate the information that is missing from a problem and explain why the problem cannot be solved without it. To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.
Differentiate **between tools used for a job.**	Given a list of tools and a list of functions, identify the most efficient tool for each task.
Assemble **or disassemble objects.**	From a list of oral or written instructions, assemble an object or complete a process. Students write the instructions for disassembly.
Cross-reference **materials to compare information.**	Using more than one source document, compare the information given.

Interpret **reasoning behind rules or regulations.**	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
Show contrasts **between approaches.**	Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.) Compare and contrast each approach from the perspective of a worker, manager, supervisor.
Organize **data in a new format.**	Using workplace materials*, organize the information into a new format.
Prove **a rule or method's sufficiency.**	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
Show **relationships between two or more systems.**	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
Given examples of emergency situations, *identify* **real world course of action.**	Using an emergency situation common to your industry, outline a step-by-step plan for action.
Identify **variables that affect the outcome of a process.**	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
Infer **situations that meet guidelines when complete information is not available.**	Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy. Discuss or debate the issues.
Compare **finished products to a set of guidelines.**	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).

	List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
Identify **preventative measures for maintenance of a system.**	List the needed routine maintenance to keep a system working properly.
Predict **new standards or rules that may become necessary in the future.**	Identify recent areas of change or development in your industry. Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).
Improve **a process by streamlining (locating waste) or decreasing lost time.**	Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient. Isolate the cause of failure in a process by performing an experiment.
Prepare **a model explaining a concept.**	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

[1] Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists,* 4th ed. ISBN 0-13-028185-9.

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing
Problem Solving
Operations and Calculations
Applications
Data Analysis and Display

Objectives	**Classroom Applications to Industry**
Present *Review and Discuss* *Master* **the list of skills employers want for the workplace regarding mathematics.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
PROBLEM SOLVING	
Examine ***Apply*** **problem**-solving process.	Define the problem What is being asked? Decide on a type of solution Multi-step or single-step question? Try any of these: Estimate an answer Draw a diagram Find a pattern

	Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation Locate information you need Do you have all the components? Get missing information May need to perform some other calculations Calculate Look at the answer. How should the remainder be expressed? Check the solution Is it reasonable?
OPERATIONS AND CALCULATIONS	
Read, write, **and** *count* **numbers.**	Read and write numbers (especially focus on very large and very small numbers where mistakes are common). Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 > or < Put these in order from smallest to largest: 0.66, 0.677, 0.67
Round **numbers.**	Discuss your industry's use of decimals. Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.

	Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.
Estimate **numbers.**	The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations where estimation is used. Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills. Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)
Compute **averages.**	Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples. Using workplace materials*, calculate a series of averages. For example: • Take 10 different measurements of a piece of pipe using a micrometer. • Compare the measurements. • Find the average of all the measurements. • Compare the average to the smallest and largest measurement. • Discuss the effects on quality…when is an average an acceptable benchmark measurement?
Calculate **with whole numbers: perform one-step problems with basic operations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.
Perform **problems that require an**	Using workplace materials*, make a list of

understanding of the order of operations.	situations or problems that need more than one step to perform them. If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved. If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition. Rework the problem using addition first. Compare the answers. Discuss the importance of reasoning skills to verify that an answer makes sense.
Understand **the relationship between decimals, fractions and percents.**	Make a table comparing fractions, decimals, and percents.
Compute **with fractions, decimals, and percents, and show understanding of the relationship between them.**	Create sample problems using fractions that relate to everyday situations. ▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8 10+2+8 = 20 (recognize denominator value) $\frac{10}{20}$ Pizza $\frac{2}{20}$ Salad $\frac{8}{20}$ BBQ ▪ Add the fractions. $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$ ▪ Convert fraction to whole number. (Total answers equal 1 class's worth of answers.)

	$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ ▪ Convert fractions to percents. $\frac{10}{20}$ means 10 divided by 20 = 0.50 Move decimal 2 places right. 0.50 = 50% $\frac{2}{20}$ means 2 divided by 20 = 0.10 0.10 = 10% $\frac{8}{20}$ means 8 divided by 20 = 0.40 0.40 = 40% 50% + 10% + 40% = 100% Notice the totals add to 100%. So, $\frac{20}{20} = 1 = 100\%$ Using workplace materials*, calculate work-related questions using fractions, decimals, and percents. Calculate shipping costs for internet purchases (such as music from amazon.com).
Solve **formulas and equations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations. ▪ Work left to right ▪ Use order of operations ▪ Place numbers on one side, variables on the other side
Obtain **squares and square roots.**	Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples. Compare the difference between the 2 common answers to 3^2 (answer = 9, not 6).

	How would an incorrect value affect the work on the job?
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for length.**	Discuss industry measures and terms relating to length.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for mass/weight.**	Discuss industry measures and terms relating to mass/weight.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for volume.**	Discuss industry measures and terms relating to volume.
Measure **with a certain degree of accuracy.**	Estimate measurements. Using workplace materials* and tools, take measurements of work-related and classroom items. Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.
APPLICATIONS	
Solve **word problems.**	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
Select/apply **mathematical formula.**	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
Understand **the importance of time in the workplace.**	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.
Recognize **components of time systems (clocks and calendars).**	AM and PM Leap Year Military time

Discuss, *Identify,* *Understand* **terms relating to measuring time.**	Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.
Understand **that time can be expressed in terms of equivalencies.**	Show the time equivalencies using fractions. For example: 1 ½ days = ___ hours 1 day = 24 hours + ½ day = +12 hours 1 ½ days = 36 hours
Compute **time conversions.**	Make a table that shows the equivalencies of time units. Compute conversion problems at the appropriate level of difficulty. Examples include: • Convert minutes to hours • Convert hours to days • Convert seconds to years.
Calculate **ratio and proportion.**	Review fractions when discussing ratio and proportion. Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch). Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)
Apply **geometry principles: Use formulas for measuring shapes of 2 dimensions.**	Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc. Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter? Find the area of the tiles on the floor. Find the area of the classroom.

	Review that all areas are expressed in terms of square units (square inches, square miles, etc)
Apply **geometry principles: Use formulas for measuring shapes of 3 dimensions.**	Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units. Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.
Define **terms relating to money.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money. For more advanced students, include terms and principles of economics, finance, or statistics.
Perform **one-step problems involving money.**	Make change. Count up (rather than backwards) to make change.
Perform **multiple-step problems using money.**	Calculate gross and net earnings. Calculate ▪ Interest ▪ Sales tax ▪ Percent off ▪ Sale price ▪ Profit percentages Perform banking transactions.
Perform **business-related financial activities.**	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
Use **a calculator to perform computations.**	Identify appropriate activities that can be performed using a calculator (calculators

	allow students to concentrate on problem-solving strategies. Award prizes for weekly activities or competitions.
Calculate **measurements taken from measuring devices.**	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
Perform/prepare **an inventory.**	Use a sample group of items to prepare an inventory. Review inventory vocabulary terms. Discuss the math processes that would apply to the inventory process.
DATA ANALYSIS AND DISPLAY	
Recognize **types of visual representations.**	Charts Graphs Tables
Interpret **charts, graphs and tables.**	Answer simple questions about charts, graphs and tables. *Solve* multi-step problems involving the correlation of graphs and tables.
Collect/record **data.**	As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details. Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers. Find the range of answers (maximum and minimum). Find the average. Discuss an acceptable range of answers (±), and graph the results showing the number that fell inside and outside the acceptable range.

*Review **and** apply* **principles of probability.**	Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")
Use probability models to *predict* **chance events.**	Calculate theoretical probability of an event (e.g., the probability of rolling a 5 on a die is 1/6). Find empirical probability of an event by performing repeated experiments. Compare the 2 probabilities.
*Calculate **and** interpret* **statistics.**	Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see? For a humorous look at statistics, see *How to Lie with Statistics* by Huff and Geis.
Interpret **plans/blueprints.**	Review vocabulary and terms for plans, blueprints and schematics. Build a plan or blueprint one layer at a time, starting with the basic identifying information. Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually, or the entire drawing as a whole.
Construct **charts and tables.**	Discuss chart types and chart vocabulary. Using workplace or sample data from the class, construct tables and charts.

	For a daily example, consult *USA Today* online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data. Challenge students to bring in examples of charts and graphs containing errors.

ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing

General Science-	topics not specific to a content area
Physical Science-	Mechanics and Physics
	Energy and Waves
	Thermodynamics
	Electromagnetism
	Chemistry
	Optics
Life Science-	Cell biology
	Evolution
	Genetics and Heredity
	Human and Animal Development
Anatomy	Ecology
	Viruses
	Bacteria
	Plants
Earth Science-	Earth in space
	Solar System/Astronomy
	Atmosphere and weather
	Oceans and water
	Earth resources

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	**Classroom Applications to Industry**
GENERAL SCIENCE	
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding science skills.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers • Researching the topic of adult literacy
Perform **computations as required to solve problems.**	Use the metric system to convert units of measure. Round numbers to correct number of significant figures. Determine percentage of error. Understand validity, reliability, accuracy, and precision.
Apply **scientific method of inquiry.**	Identify the steps of the scientific method. Conduct experiments. Understand the following terminology: Conclusions vs inferences Variables Replications Samples/sample size

Investigate **science history as it applies to industry.**	In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group. Present findings in report format, or in oral presentations. Investigate science ethics. Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm [Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]
Use **scientific instruments to *measure* aspects of the environment.**	Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.
Demonstrate **an understanding of data.**	List the processes involved in gathering data. Suggest ways that data can be grouped or organized. Collect specimens. Show how data can be represented (graphically, charts and diagrams, etc) Construct a model to depict a basic concept.
Identify **the seven basic S I (Systeme International) units.**	Length- meter- m Mass- kilogram- kg Time- second- s Electric current- ampere- A

	Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd Dictionary of units- see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
Identify **S I (Systeme International) Derived units.**	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc). Create a picture dictionary demonstrating the concepts.
Review **relevant theories, laws and models**.	As relating to your industry, discuss important theories, laws and models.
Use **reference tools to solve problems.**	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
Practice **safe lab procedures.**	Handle equipment with care. Demonstrate safety and first aid procedures. Identify harmful substances.
PHYSICAL SCIENCE	
Understand **the cyclical nature of systems.**	Show, demonstrate, model, track the cycles of any of the following systems: Growth and decay Food webs Weather Water
Analyze/classify **matter according to type.**	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
Explain **the concepts of work and power.**	Identify machines used in industry. Identify how energy levels change when work or power is increased/decreased. Identify fuel sources used in your industry. Discuss internal and external combustion.

	Create a model demonstrating the uses of levers and pulleys.
Be familiar **with concepts of motion.**	Measure acceleration and deceleration Understand the relationship between speed and velocity by performing experiments. Recognize waves and vibrations as a type of motion. Understand action and reaction. Review laws pertaining to motion.
Understand **concepts related to force**.	Show the need for balance of forces acting on an object. Observe centrifugal and centripetal forces in action. Show how friction is created and must be accounted for in using and preserving equipment. Create a chart showing types of lubricants needed in a factory and schedule of maintenance. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia. Show the relationship between pressure, mass, and weight.
Understand and *apply* **principles relating to the atom.**	Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.) Identify ions.
Investigate **forms of and changes in energy.**	Discuss how energy is measured. Observe changes in energy relationships. Identify catalysts and reactants.

	Identify sources of kinetic and potential energy in your industry.
Discuss, apply **principles of electricity and electric currents.**	Identify types of circuits and switches. Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each. Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.) Identify good conductors and insulators, and how to choose them. Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity. Show the uses of a vacuum tube by building a model. Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry. As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.
Be familiar **with sound waves.**	Compare how sound waves travel between liquids, solids, and air. Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.

	Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms): Amplification Audible range Frequency Acoustics Resonance Speed
Be familiar **with principles of heat.**	Differentiate between the 3 types of heat transfer (conduction, convection, radiation). Understand that substances expand and contract due to heating and cooling Identify purpose and types of insulations used. Differentiate between heat and temperature.
Investigate **and** *apply* **concepts relating to temperature.**	Use the temperature scales; convert between Celsius and Fahrenheit.
Explain **the concepts of magnetism.**	Understand that currents create magnetic fields. Identify materials that are good conductors, and the properties that make them such. Understand electromagnetic forces present in earth.
Investigate/apply **chemical properties.**	Differentiate between acids and bases. Find pH for substances used in industry. Identify substances used in your industry and classify them by type. Name the major drugs, fertilizers, or additives used in your industry. Define and state examples of chemical reactions. Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble.

	Explain solute and solvent.
Investigate **forms of and changes in matter.**	Compare and contrast physical and chemical changes. Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.
Understand **and apply concepts relating to the elements.**	Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)). Element Groups: Alkali Metals Alkaline Earth Metals Transition Metals Other Metals Metalloids Non-Metals Halogens Noble Gases Rare Earth Elements
Be familiar **with principles of light.**	Discuss light as a form of energy. Describe types of lighting systems. Examine the light spectrum and note the relative smallness of visible light. Define reflection and refraction. Explain how light carries information (by lasers) and show examples of the impact on technology/industry. Identify types of lenses.
Be familiar **with principles of color.**	Diagram the main parts of the eye involved in seeing color (rods, cones). Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?

	Define situations in which colorblindness impacts a worker's ability to do his job.
LIFE SCIENCE	
Explain **the presence of cells as the identifier of all living organisms.**	Examine the cells of organic material used in your industry, using books, the internet, or a microscope. Recognize that cells divide or replicate to promote growth of an organism. Examine the parts of a cell. Compare the cell to a machine…how do the parts function and rely on each other? Give example of one-celled and multiple-celled organisms. Review the classification system of all organisms (Kingdom, Phylum, etc). Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms: Bacteria Fungi Viruses Insects Plants Vertebrates Invertebrates Compare some of the cell processes (active and passive transport) to the processes in your industry.
Understand **the progress of evolution of organisms.**	Recognize how a species will adapt to better fit in its environment over time.
Explain **the role of genetics in human development.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including: • Half of an individual's genes are contributed by each parent • Traits that are inherited are either dominant or recessive from the parent(s)

	• Cell division by mitosis versus meiosis • Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
Investigate/apply **principles of human development.**	Describe the life cycle of humans and other animals. Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.
Explore **additional concepts pertaining to humans and other animals.**	Give examples of ways organisms adapt to their environment. As relating to industry, review the concepts of: Aging Immune system Skin and Tissues Blood and hemoglobin Disease
Compare/contrast **the differences between sexual and asexual reproduction.**	Determine instances when understanding the concepts of sexual reproduction are important for your industry. Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.
Show **a general understanding of the importance of health.**	Explore the cost of lost wages and worker's compensation in the past year due to health problems. Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)
Investigate **the food cycle.**	Identify food chains, food webs, food pyramids. Show how changes to the food cycle affect the

	environment and affect man. Name the food groups.
Understand **nutrition and the body's need for a diet that provides vitamins and minerals.**	Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry. Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)
Observe **health code/sanitation requirements.**	Research the development of health code and sanitation requirements, including OSHA. Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety. Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts). Discuss potential effects of ignoring health requirements. After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each. To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc. Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded. Explore proactive measures students can take to extend their health. Understand the importance of mental health in

	addition to physical health.
Investigate/apply **principles of anatomy and physiology.**	As relating to your industry, explore issues relating to anatomy and physiology. Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome. Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.
Understand **basic principles of Ecology.**	Define ecology. Identify 5 major ways in which man interacts with the environment, especially as relating to your industry. Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues. Identify any areas of concern regarding waste/waste management in your industry. Show the difference between a niche, community, habitat, and ecosystem. Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group? Understand predators' effects on food chains. Identify predators of industry. Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?
State **the differences between viruses and bacteria.**	Define viruses and bacteria. Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated? State the benefits of viruses and bacteria.

	Explain the recent increased resistance to drugs and antibiotics.
Understand **basic concepts relating to plants.**	Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide. As relating to industry, review the concepts of: Fertilization Parts of plant, and functions of each Effects of temperature on plants Need for water and light Photosynthesis
EARTH SCIENCE	
Recognize **earth's position in the universe.**	As relating to your industry, identify relevant topics regarding Asteroids Comets Stars Galaxies Identify planets in the solar system. Compare and contrast earth to other planets. Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ___ so the sun should be the size of ___). How do the phases of the moon and sun affect the hemispheres?
Investigate **history of the earth.**	Identify geological, chemical and other methods of determining the age of an object. Demonstrate that fossils and rocks are indicators of previous eras. As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each. Make sure the timeline is drawn to scale.

	Assign each Age to a group and research the following: Weather Major events at beginning and end of age Organisms living during this time Factors that made the Age unique
Investigate **physical characteristics of the earth.**	Label/model the components of the earth. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity. Solve problems of longitude, latitude and time zones. Create a model of the ratio of land and water on earth.
Investigate **physical forces acting on the earth.**	Examine erosion and depletion of nonrenewable resources. Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).
Explain **the basic components of earth's rotation.**	Understand that the earth spins on its axis at an angle of 23 ½ degrees Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons. Discuss time zones.
Identify **the earth's atmosphere and its components.**	Identify the main elements in the earth's atmosphere (nitrogen and oxygen). Identify layers of the atmosphere, and the ozone layer.

	Explain concepts of air pressure.
Understand **basic principles of the solar system.**	Demonstrate how the sun strikes the earth at different angles depending on location.
Demonstrate **the relationship between climate and weather.**	Identify the factors that create weather. Show how landscape features are affected by changes in climate or weather. Identify the greenhouse effect. How does industry contribute to it? Describe the relationship between altitude and weather. Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream. Identify types of precipitation. Differentiate between types of clouds. Understand the effect of winds, wind speeds, and impacts on vegetation.
Learn **and** *apply* **concepts relating to the oceans.**	Label the major oceans and seas. Determine the elements in ocean water (nearly all elements are present). Identify or draw the structural components of the ocean floor. Explain the relationship between the moon and the tides. Explore ways the ocean is used for power and business.
Investigate **principles of water.**	Identify the parts of the water cycle and the effects of the processes involved. Define water's chemical properties water is the universal solvent water has a neutral ph of 7

	chemically, water is one atom of oxygen bound to two atoms of hydrogen) Measure salinity. Which industries rely heavily on water? Define water's physical properties water is the only natural substance that exists as solid, liquid, and gas water's surface has a high density water has a high tolerance for heat (heat index) water's weight water as a coolant specific gravity
Investigate **conservation of physical and natural resources.**	As relating to your industry, discuss or debate the issues of Allocation of resources Recovering resources Best/worst methods of using resources Compare/contrast renewable and nonrenewable resources. Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation. Discuss alternative sources of energy as relating to your industry.
Investigate **issues regarding scientific technology.**	As relating to your industry, discuss the uses of technology. What are the newest developments? What effects does the technology have on our society? Political system? Discuss the role of economics on technology.
Apply **science principles/laws to environmental issues.**	Discuss how mankind alters the earth and environment through use of resources and technology, pollution.

Crosswalk to SkillsUSA Contest in Major Appliance Technology

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of major appliance technology. First, refer to General Regulations, Page 9.

Clothing Requirement

Official SkillsUSA khaki work shirt and pants, black or brown leatherwork shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: http://www.mwtrophy.com/vica/index.html.

Eligibility

Open to active SkillsUSA members enrolled in programs with major appliance technology as the occupational objective.

Equipment and Materials

- Supplied by the technical committee:
  - All necessary appliances and special tools
  - All necessary information and furnishings for judges and technical committee
- Supplied by the contestant:
  - Toolbox
  - 4" and 6" flat-blade screwdriver
  - Stubby flat-blade and Phillips screwdrivers, torq head screwdrivers—no electric screw-drivers will be allowed
  - Wire stripper
  - Diagonal pliers

- Common pliers
- Arc joint pliers
- 1 /4 " drive socket set
- Solderless terminal pliers
- 12-oz. ball peen hammer
- 8" adjustable wrench
- Clip leads
- Set of hex wrenches
- Volt-ohm-millimeter
- Flashlight
- Swedging.212

- Service and Maintain Other Systems Including:
  - Gas burners
  - Dispenser valve
  - Check valves
  - Couplings
  - Condenser
  - Evaporator
  - Filter
  - Hoses
  - Main gas valve
  - Regulator valve
  - Spray arm
  - Water inlet valve
- Adjust the Following:
  - Cams
  - Door latch
  - Gas orifice
  - Mounting supports and pulley belts

- Replace/Adjust the Following:
    - Agitator
    - Basket
    - Blower assembly
    - Circulation motors (exhaust, defrost, cooling)
    - Center post tub gasket
    - Door gasket
    - Door handle
    - Door latch cable
    - Door springs
    - Drive gear chain
    - Drive motors
    - Drum rollers
    - Drum support bearing
    - Blower wheel
    - Filter
    - Grinding chamber
    - Hinges
    - Ice tray
    - Impeller
    - Insulation
    - Pulley belts
    - Seals
    - Tub
- Troubleshoot and Diagnose the Following:
    - Refrigeration system
    - Electrical system
    - Drive systems
    - Plumbing system
- Leadership
- Customer relations

- Job application and interview

Items Evaluated

- Locating and/or correcting malfunctions
    - Refrigerators
    - Electric Ranges
    - Microwaves
    - Electric Dryers
    - Washers
    - Dishwashers
    - Brazing
- Written test
- Customer Relations
- Job Interview

Note: Contestants will be rated on the proper use of tools and test equipment, speed, accuracy and safety. All standard industry safety practices will be followed. *Sponsored by Goodheart-Willcox Publisher* 213

An Oral Professional Assessment will be included. Points to be determined by national technical committee..214 *SkillsUSA Championships Technical Standards (2002–2004).Sponsored by Goodheart-Willcox Publisher* 215

Arkansas's All Aspects of Industry

Defining "All Aspects"

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.

Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology. Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior
- Communicating safety regulations and plans to employees
- Working with selected community groups to implement safety programs.

Major Appliance Repair
Framework Cross Reference

Major Appliance Repair I

Unit 1	**Safety**	**Duty(s): A**
Unit 2	**Tools and Equipment**	**Duty(s): E**
Unit 3	**Fundamentals of Electricity**	**Duty(s): B,D**
Unit 4	**Electric Motors**	**Duty(s): C**
Unit 5	**The VICA Student Organization**	**Duty(s): A,B**

Major Appliance Repair II

Unit 1	**Clothes Washers**	**Duty(s): F**
Unit 2	**Clothes Dryers**	**Duty(s): G**
Unit 3	**Refrigerators and Freezers**	**Duty(s): N**
Unit 4	**Dishwashers**	**Duty(s): H**
Unit 5	**Microwave Ovens**	**Duty(s): K,L,M**
Unit 6	**The VICA Student Organization**	**Duty(s): A,B**